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ABSTRACT

Objectives of a study conducted by a two-year college were to (1) enable representatives of hiring industries and governmental agencies to help evaluate or initiate a selected vocational curriculum and to establish procedures for continuous change and upgrading in cooperation with the postsecondary institution; (2) determine which of the general education requirements are necessary for employment (i.e., what kind of English, math, etc.); (3) maintain an accurate file of immediately available and emerging jobs from industries who will hire trainees and obtain continuous input from those responsible for hiring; and (4) devise a method of determining the point during the student's study and training where he/she is able to obtain employment. Interviews were held with personnel from a group of sixty participating employers employing more than 30,000 employees. In this report, discussion and opinions are presented in twelve sections and include procedures for establishing a new curriculum, involving women in vocational education training, the advantages of apprenticeships, and an electromechanical technology course model. Sixteen summary comments and conclusions are presented and include that vocational educators must leave the isolation of the classroom and establish face-to-face liaison with personnel managers and shop supervisors in their particular curriculum industries. A manual for setting up a curriculum is appended. (BL)

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FINAL REPORT

PROJECT NO. 498AH60189
GRANT NO. G007603433

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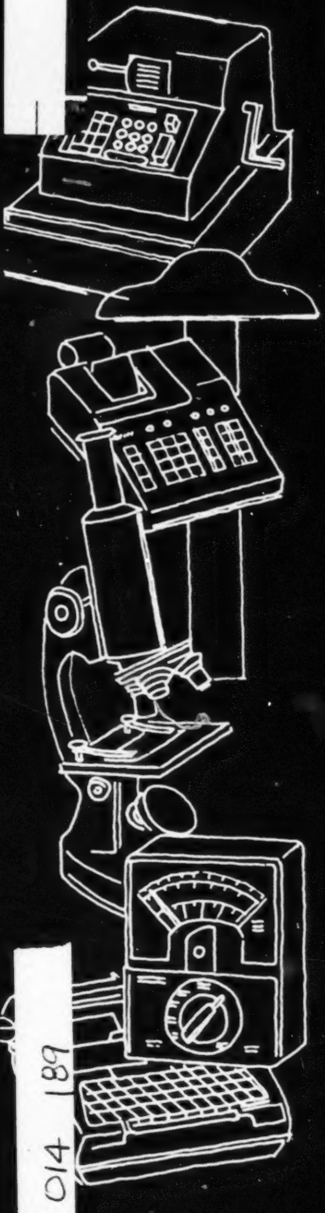

METHODS AND PROCEDURES FOR JOB IDENTIFICATION AND PLACEMENT BASED UPON INDUSTRIAL NEEDS

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Development of Methods and Procedures for Job Identification and Placement of Students Based Upon a Curriculum Continuously Evolving From Industrial Needs

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U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

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Foreword — Principal Investigator

We in this country are justifiably prideful concerning our technological expertise and high standard of living, one of the highest in the world.

But, along with the rest of the world, our social system has not kept pace with our technology. It is an undeniable fact that the "professional" enjoys a higher status than the technician, and that the office worker is a cut above the blue collar worker, socially speaking.

Although we live in the Age of Technology, our social attitudes remain those of the Industrial Revolution for the most part, and in some instances, hark back to an earlier class-ridden agrarian society. Even today, inherited wealth has greater status than newly-earned money.

Still, time is inexorable. The force of accelerating technology has created an impact on social values which will certainly change our attitudes to fit the times. The high school graduate of today is questioning traditional educational services more than ever before and states flatly that relevance to his needs is not the aim of educators. Students today realize the emptiness of college degrees if no jobs are available for them to utilize what they have learned.

Especially in this day of high unemployment, students demand to know whether the vocational programs now offered to them in the schools contribute directly to job entry or not. Even the liberal arts student, trying to cope with rising tuition costs, is looking toward quick, short-term training for part-time jobs to get him through the economic squeeze. Many seeing the high salaries -- and steady employment — of their technician peers, are questioning the value of a college degree as a means to a better living.

But how to find a job remains the crux of the problem. Too often, a student discovers that the skills he was taught are outmoded, too specialized, or without a market. Yet, many jobs go begging simply because there is a dearth of trained recruits.

When this study was begun, it was apparent that the main thrust of investigation would be: How to bridge the gap between what business/industry needs and what vocational/technical education offers.

What is needed is to find out, from industry itself, just which skills it will pay for, how current the skills are and how continuous training updating can be accomplished; and how soon and on what basis a student can get a job.

The business/industrial community has long been interested in placing in their training programs young people who are partly or basically trained by schools. But too many schools and colleges fall short in providing adequate and/or current programs because the changing needs of industry are not taken into account. All too soon the student discovers that what he has learned is not what industry needs, or that it is no longer relevant. And the gap is widening.

It can be closed only if action is taken to mesh student skills and knowledge into job requirements. This must be done on a localized, individual basis, requiring schools to take the initiative in approaching industry to determine its needs before drawing up curriculums. Given a proper approach, industry in most cases is very receptive and helpful, and often grateful.

Although this study focuses primarily upon a basic technology, care has been taken to uncover methods applicable to most vocational and technical careers in the interest of diversity of employment for the student. If employment slacks off in one particular area, every technology should be sufficiently malleable to be adapted to allied areas.

We have depended on information and advice of experts in industrial, business, technical and specialized fields, and "hands-on" vocational educators.

Much thought and consideration was given as to whether we should depend on the traditional questionnaire in obtaining our data.

Having learned the value of oral testimony from my years as an apprentice, as a shop worker, in tunnel construction and my experience in the U. S. Navy, I and my colleague Frank O'Brien, sought out and profited by conversations with technicians, mechanics, engineers, managers and other employees. We attempted to avoid hearsay. The experiences of these men (and some women) span a period of great development in American industry and business. We found these diverse people surprisingly willing to assist in mapping out a course for job entry and upward mobility of students and adults alike.

One salient point emerged from all the interviews: Most did not care to answer written questionnaires. They felt that the time expended on filling out the forms was wasted because the picture that emerged, for the most part, was distorted or slightly erroneous, and structured for a narrow choice of conclusions.

Also, doers are not necessarily facile with the written word. Very often, a face-to-face interview produced many insights and observations which would have been lost to the reluctant pen. Although the on-site interviews were time consuming, the results were very rewarding in gaining rapport, liaison and downright "tell it exactly like it is" in the job market (rather than what educators think it ought to be) information. It is impossible to overstate the absolute necessity for the teacher and/or the administrator to abandon his comfortable aerie and convenient schedules for "where the action is."

We apologize to the veteran vocational educator for restating facts here and there which seem over-obvious; but hopefully, this will be minimal and is offered primarily to help novices and others in the field.

It is hoped that industry and business will find the study helpful for tapping trained labor sources, and for educators as an aid to the formation of career programs that are relevant and adaptable to an ever-changing job market.

Clifford L. Rall
Principal Investigator

Comments from Business and Industry — William McCullen

The value of the concepts and approaches reflected in this research project is evident to those employers in the I-270 Corridor Employers Group who have participated in this undertaking with the Germantown Campus of Montgomery College. Our group of approximately 60 employers in both the private and public sectors employs more than 30,000 people in the area.

The concept was presented at one of our regular membership meetings. Initial reaction varied from no interest to enthusiastic support. Essential to the success of this undertaking was the follow-up by the College staff, first with those who had expressed interest and then the cultivation of contacts who could utilize and benefit from the project but had not expressed initial interest.

It soon became evident that this approach would benefit both the employers in that it would provide a pool of educated and trained labor and at the same time the students for whom well-paying career opportunities opened up.

All too often in the past employers have had to select, for hiring, applicants who had been educated or trained in outdated technologies and equipment.

Aggresive, ongoing, continuing contact with the right technical, training and personnel people in industry has been a most significant difference in this program.

The College staff has gained timely knowledge of national and local trends by their on-site visitations to the various places of business in the county.

Employers' eyes have been opened to many new possibilities for upgrading the quality of their workforce.

This cost-effective approach is a preparation for on-the-job training and in-house training provided by the employer or in cooperation with Montgomery College at its Germantown Campus or on the employers' premises.

This program and approach need not be restricted to an electromechanical curriculum.

It can, has and should be utilized for other vocations such as retail merchandising. One of the major area employers has, for the past two semesters, conducted courses in accounting taught by Montgomery College as part of a long-term series of college credit courses on company time, at company expense on its premises.

This undertaking is providing a pool of qualified, upgraded employees who are available for promotional opportunities. Numerous employers have tuition refund plans that, if pursued, can provide well trained workers where the size of the business does not permit special classes.

Participation from the employers came principally from the larger firms. However, some I-270 employers with as few as 50 employees also took part in the program.

Among the I-270 Corridor Employers Group, the following employers have been part of the program at one time or another:

Bechtel Power Corporation; Comsat; Control Data; EG&G Washington Analytical Services Center; Energy Research & Development Administration (ERDA); Exotech; Fairchild Space and Electronics; Flow Laboratories; Gillette Research Institute; Hewlett-Packard; International Business Machines (IBM); Kettler Brothers; Kodak; Montgomery County Division of Manpower Services; National Bureau of Standards (NBS); National Geographic Society; Quanta Systems; Remac Information; Roy Jorgensen & Associates; Tektronix; Tracor; Watkins-Johnson and Weinschel Engineering.

The responsibility for the development and success of this program is shared by the educational institution and the business community. Realistically the impetus must come from the education side as they aggressively inform and work with the employers in providing this timely and effective service to the community.

The employers must cooperate by providing advice and counsel during on-site visitations, job descriptions, recommendations on curriculum content, latest technology, equipment and precisely what they are looking for in those they employ.

William H. McCullen
President
I-270 Corridor Employers Group

Acknowledgements

This study to develop methods of obtaining jobs based upon the careful updating and alignment of vocational and technical training with industrial needs has involved many individuals, businesses, organizations and institutions.

Acknowledgments are due:

Dr. William C. Strasser, President of Montgomery College, whose vision and comprehension of the necessity for vocational-technical education in the two-year college have long been apparent.

The Montgomery College Board of Trustees, and particularly Chairman Jean G. Ross, who have consistently supported the need for vocational programs and especially the electromechanical curriculum utilized in the study.

Campus Dean Stanley M. Dahlman, a classical scholar, who because of his comprehensive understanding of the educational needs of our society, has enthusiastically supported the grant proposal and the application of our findings to the implementation of a technical curriculum on his campus.

Peggy J. Bebee of the Germantown Campus for her assistance in preparing the proposal, her advice throughout the project, and her critical review of the final report.

The I-270 Corridor Employers' Group who early supported the concept of the study and the many members who opened their doors and their shops to make available the cooperation of skilled and knowledgeable specialists on all levels.

Our colleagues in education:

Professor Marjorie B. Edwards (for her design of a special course in English for vocational-technical students); Dean of Instruction O. Robert Brown (mathematics); Dr. J. Michael Meade (counseling); George Davis, Jr. (financial advice); and Stanley Voth (for his suggestion which brought about the proposal application); -- all of Montgomery College.

Also: Director of Articulation Walter V. Hohenstein, University of Maryland; Joseph A. Scarlett of the Catonsville Community College and a member of the Governor's Committee on the Status of Women; Walter M. Arnold, former Assistant Commissioner for Vocational and Technical Education, U. S. Office of Education.

And: Executive Director Brent M. Johnson of the Maryland State Board for Community Colleges; Executive Director Michael R. Morton of the Maryland State Advisory Council on Vocational-Technical Education; Joseph P. DeSantis, Specialist in Post-Secondary and Adult Education, Maryland State Department of Education.

Others in business and industry: Gary Johnson, Fairchild Space and Electronics Company; William H. McCullen, Walter M. Bailey and Don R. Hollar of IBM; Dick Harries, A. B. Dick Company; George C. Uzzell, Genco Tool and Engineering Company; Richard Smith, Remac Information Corporation; Karl E. Bell and Albert E. Ledford of the National Bureau of Standards; also Lloyd's Electronics of Edison, New Jersey; and John C. New of the Goddard Space Flight Center.

To these must be added many others who furnished information and sound professional opinions incorporated into this final report.

And finally, we are especially grateful to Project Officer David H. Pritchard of the U. S. Office of Education for his counsel and assistance during the period of the grant.

Abstract

The Germantown Campus of Montgomery College in Maryland has developed methods to enable vocational and technical candidates for employment to obtain jobs based upon training which is continually adapting to emerging job requirements. Basic to this study is the recognition of continuity as an ever changing force, and a realization that technology in the employers' shops is changing -- intermittently, sometimes slowly, and at other times in revolutionary spurts.

The problem is to identify common needs in curriculum industries* by procedures involving a sufficiently large representation from these industries. The other major step is to adapt and change the college curriculum to continually meet job requirements.

The Germantown Campus is in the unique position of preparing to introduce a basic technology, electromechanical, in the midst of approximately 100 employers in the public and private sectors, many of whom are ready to employ these students after sufficient training.

The researchers, one of whom has been selected to teach the electromechanical curriculum in the new campus when it opens in 1978, have utilized this curriculum as a vehicle for specific research. Section XI of the study constitutes a concise report of what has been accomplished to prepare for the launching of this specific curriculum. The report follows those procedures in the study uncovered by evolving contact and interchange with electromechanical industries in the Germantown Campus area.

Personnel administrators, supervisors and managers have made valuable suggestions regarding the availability of jobs, job projections and methods of obtaining employment. The concept of encouraging the student to apply for a job as soon as his training in a specific program permits, has received almost unanimous support. But in most cases, company representatives strongly suggested continued after-work study of skills and knowledge relating to the job.

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*A curriculum industry is one which employs students trained in a specific technology or vocation.

It was found that courses in English relating to the vocation or job are highly recommended -- the ability to write memoranda, describe problems, use the nomenclature of the vocation and the ability to communicate in written and oral form are considered essential.

The amount of mathematics needed is dependent upon the vocation or technology. But a sound knowledge of arithmetic including formulas and elements of geometry and algebra as now taught in public school eighth grades suffices for many vocations and some basic technologies. Those who have completed the usual high school mathematics -- algebra, geometry and possibly trigonometry -- are well prepared to begin a study of most technologies, and also a computer language such as FORTRAN.

Because of the great number of highly specialized professional personnel in the Washington, D. C. area, the researchers were able to call upon outstanding consultants -- many volunteered their help -- to offer services with regard to the handicapped, women in the work force, articulation, specific curriculums, equipment selection, et. al. Their evaluations, suggestions and opinions are reflected in the study.

The study which was conducted with the assistance of the I-270 Corridor Employers Group (56 industries and 30,000 employees) strongly indicates that the time has come for a new concept as regards industry and the two-year college, a meshing of gears which are compatible, but which up to now have seldom made contact. This project may well propel many two-year colleges and vocational institutes into an effective relationship with industry which can only prove rewarding to the job holder and his employer and of considerable benefit to our society.

Section I—Introduction and Purpose

This study deals specifically with post-secondary education, although there are implications here for comprehensive and technical high schools as well. The major scope of the project encompasses vocational and technical programs in the two-year community college and specifically seeks to develop procedures for job identification and placement of students based upon a curriculum continuously evolving from industrial and/or business needs.

Since approximately half of the post-secondary and community college enrollment is made up of adults, their job needs, desires and opportunities are considered an integral part of the project.

As described in Section XI by Frank E. O'Brien who served as full-time research associate for the study, the electromechanical curriculum was utilized as a model and vehicle for research. This curriculum was selected because of (1) a local need for those so trained; (2) the curriculum is nationwide, but not yet fully implemented; (3) it is a basic systems technical curriculum including electrical and mechanical elements; and (4) Technical Education Research Centers Inc. had made a thorough search of its need and developed its curriculum elements through a Federal grant.

In other words, the electromechanical curriculum is basic to industrial needs, and conclusions drawn because of its utilization would apply to most technical programs.

This project was instituted to establish procedures which will enable students and adults to be certain that the skills and knowledge they master in vocational programs and course modules are those currently required by industry.

Included also is an examination of how to obtain jobs based upon what the industries require. This meant going beyond filing an application or resumé and waiting for something to happen.

A method was needed to find out what constitutes "shop and skills" knowledge in a particular technology or business and ensuring that the individual is trained so that the industry will seek him as he is being trained.

This we found, is possible only by establishing and maintaining close relationship between the vocational staff of the educational institution and the shop and technical personnel of the industries.

For continuous curriculum revision, it is essential to develop a system of inputs from industrial and business employers and especially supervisors who are "shop knowledgeable." This must be done on a continuous basis to ensure adequate representation.

However, the curriculum must be kept sufficiently broad and flexible to enable students and enrolled mature workers to develop a career ladder which may in some cases include completion of a baccalaureate major.

Flexibility in the curriculum with emphasis upon general principles will provide upward mobility for the individual and also enable him to move to more promising jobs.

Advisers in industry and advisory committees have been examined to determine effectiveness in assisting the industries to obtain properly trained recruits and the educational institutions to make certain that curriculum offerings mesh with industrial needs. Methods have been devised to ensure reasonable success in this regard.

It became apparent early in the study that it would be impossible to schedule Task Force and other committee meetings on a regular basis because the individual employed in industry simply does not have the time to give.

This problem was solved by conducting a minimal number of meetings and substituting carefully selected conferences with individuals possessing the knowledge and experience needed.

The number of technicians, supervisors, managers, personnel managers, company training officers, company instructors, technicians and workers on the job, and college personnel contacted during the study totalled 183.

Various outlines and questions were utilized on a trial basis until there emerged a generally structured method of inquiry to be used by the researchers. This enabled those being interviewed to volunteer considerable information based upon their knowledge and experience and to offer suggestions of practical use.

INTERVIEW MATRIX

	Personnel Category						
Types of Persons Interviewed	Manufacturing	Repair Shops	Engineers	Post Sec Ed	Gov. Agcy	Students	TOTALS
Technicians	11	4	16		9		40
Personnel Manager	6	7	12		3		28
Training Officer	6	2	7		5		20
Educational				21		6	27
Technical Supervisor	7	3	8				18
Manager	20	8	8		14		50
TOTALS	50	24	51	21	31	6	183

In devising methods of gathering data in submitting the proposal for the Federal grant, it was decided to avoid the limitations of the usual survey form with its small choice of possible answers, structured rigidity and thought restriction.

Instead we would rely upon oral replies from carefully selected specialists most of whom were successfully employed in technical and business pursuits.

To these were added educational personnel including a percentage of full or part time employed students.

All interviews were conducted by two researchers who focused upon the four basic objectives of the study:

a) To enable representatives of hiring industries and governmental agencies to help evaluate or initiate a selected vocational curriculum and to establish procedures for continuous change and upgrading in cooperation with the post-secondary institution.

b) To determine which of the general education requirements are necessary for employment (i.e., what kind of mathematics, history, English, foreign language, etc.).

c) To maintain an accurate file of immediately available and emerging jobs from industries who will hire trainees in the specific curriculum; to obtain continuous input from those responsible for hiring; to explore methods of ensuring continuous liaison of the institution with those in the curriculum industries.

d) To devise a method of determining the point during the student's study and training where he is able to obtain employment. This will be based upon an instrument which will take various variables into account, including fluctuations in the labor market, for his curriculum, individual levels of practical skills and knowledge, and specific requirements for the job opening.

Interviews almost always took place in areas where work was in progress, e.g., shops, offices, field repair sites.

By the time twenty-five or more conferences had taken place, a pattern emerged which encouraged the supervisor, technician, educator, etc. to give free rein to his imaginative thinking and to draw upon appropriate training and experience.

Thus, there became established a method of obtaining current shop information, inspecting equipment and tools, examining products, and building a liaison between the college and the curriculum industry.

Essential to the study was access to sufficient industries which are interested in hiring those who would be enrolled in the selected curriculum. It was possible to obtain cooperation of the I-270 Corridor Employers Group described by Mr. William H. McCullen earlier.

Mr. McCullen's employer, the International Business Machines Corporation (IBM) demonstrated the help we might be able to get from large employers. This was proven many times over by member industries of the I-270 Employers Group and others.

Frank E. O'Brien established an additional list of 50 smaller curriculum industries which are described in Section XI.

In order to avoid provincialism, contacts were made in other states and regions of the country: colleges and others offering electromechanical and other curricula, instructors and industries. In all cases we received reasonable to enthusiastic cooperation.

Since this nation is presently in the midst of metric conversion, it seemed logical to determine implications for post-secondary institutions working with business and industry. The National Bureau of Standards (NBS) only a few miles away proved a feasible starting point.

The computer processing center assists in executive decisions, solves problems for engineers and technicians, aids in medical diagnosis, stores information for scientific research and maintains business records. It is an integral part of our daily lives and especially of those preparing to begin vocations and looking to upward mobility in their careers.

Implications leading from the computer revolution of the 1960's and on, and affecting most industries are discussed by Mr. O'Brien in Section X.

The interviewing method of obtaining very accurate information about the need for a curriculum and subsequent opportunity for trainees may possibly show that the need is transitory and dead-ended.

School authorities at this point must decide to phase out (if the curriculum already exists) or back off altogether.

This will take courage because funds may have been spent, jobs already filled, facilities provided and bonds sold.

But to do otherwise is to mislead parents and students by leading them to a non-existent future career in the real world.

It may be possible to adapt that which exists or has been financially established to another need. Certainly space can be utilized for many purposes; instructors can be changed and new curriculums implemented.

In fact, all new facilities should be designed with an eye for flexibility and change.

Today there appears to be an emerging broadening of the base in technology areas. By this I mean a move from a need for component oriented technicians -- such as electronics -- to a systems consideration.

This does not eliminate needs for understanding and skills relating to components, but it does focus upon a systems understanding, trouble shooting, design and problem solving for students moving toward careers in companies employing electrical and mechanical technically trained individuals who are ready for the specialized company provided on-the-job or other training.

Not too many years ago, personnel recruiters sought assiduously to find young men (women were not then largely considered) who were "mechanical."

Many companies administered skills tests which involved puzzles, timing, matching, identifying, etc. How these applicants obtained their skills and "mechanical understandings" was not of particular concern.

Many potential technical workers never get a chance to contribute to our technical society and at the same time satisfy their ambitions for self-realization. Some are fortunate enough to follow the apprentice route.

High schools, trade schools and community colleges must turn their attention to determining current and projected needs in our technical society and spell out exact opportunity goals to our young people which are realistic and immediate.

I say "immediate" because like young men and women of past generations, they want to work, get married and later enjoy the fruits of their labor.

There is a continuous need for college and advanced scientific/engineering training. There is and always will be a necessity to sustain the continuity of society through the concentrated efforts of scholars and researchers into the history of man's efforts and achievements upon earth.

Those who work with their hands and vocational knowledge have a great inheritance in these liberal arts areas. They are entitled to continue the sparks, thirst and enthusiasm which must be ignited and fed during their secondary (and before) schooling years.

As the full-time workers continue their training and education during after-work hours, some attention should be given to history, literature and languages for those who are interested.

Often a refresher course in arithmetic is needed. Today's public schools include elements of algebra and geometry before the student has completed the eighth grade. A one semester review coupled with new, related material can be taught and learned with motivation and enthusiasm.

These subjects are becoming steadily more important due to increased leisure time and because of the slow but sure contributions of the mass media to individual well-being. Science and mathematics should be considered in relation to the worker's job.

BUT the essential need for the eighteen year old seeking work is immediate training in a career.

One of the criticisms leveled at our two year colleges is a requirement to enroll in general education at a time when the worker is struggling to get established in a job. If after four years of high school English, or less if a dropout, the worker needs minimal English education to meet the job requirements; he should be enrolled in a course specially designed for working men and women.

The general first semester freshman course in English followed by literary reading and critiques is not what is needed.

This training in reading and writing English should be designed with college/high school teachers and business representatives as equal partners.

The U. S. Office of Education, recognizing a need to research the possibilities of meshing industrial practice with evolving curriculums and a need also to establish methods of early job placement, granted funds for these purposes to the Germantown Campus of Montgomery College

This study then, has emphasized two basic goals: (1) preparing the candidate with continuously updated knowledge and skills needed by industry, and (2) helping the candidate get a job as soon as he is able to do the work satisfactorily.

Section II—Establishment of a New Curriculum

The procedure to establish a new curriculum applies equally to the initiation or upgrading of a curriculum as to its upgrading in alignment with curriculum industries.

(1) The initial step is to undertake an inventory of industries which might employ students to be trained in the school's projected curriculum.

The number to be inventoried would depend upon the geographical limits to be served by the school and the curriculum industries in the area.

It is possible to obtain lists and classifications of businesses from county or city agencies, chambers of commerce, local trade associations, and state departments of commerce and labor.

From these a few industries could be selected for personal visits to mention the school's intent and to obtain initial cooperation and suggestions.

After compiling this incidence study, we are in a position to determine which kinds of industries project sufficient employment needs to warrant establishment of a curriculum. Occupational outlook projections are available from governmental agencies as a starting point.

Information should be collected on an inventory or profile card to be devised by the instructor and contain such items as: products manufactured or designed, names of supervisors and personnel officer and other information relative to each particular business.

Most companies will make available brochures, annual reports, copies of in-house publications and other information; also job titles and descriptions as well as any other information about the company which would indicate necessary qualifications for applicants.

The profile card is intended to be a source of the company's training needs and employment projections. It must be systematically updated.

Other suggested profile card information: total number of employees in each curriculum industry, estimated turnover and projections, and other available data to determine whether the curriculum industry shows sufficient need for trained individuals over a long term (10 year) period.

It is strongly urged that inventory information be gathered by personal contact, thus making possible a friendly interchange between the instructor and those who will employ his students.

The initial contact is critical and, therefore, should be carefully planned to "sell" the company representative on what the school intends to offer in helping to meet company needs.

Not only should the school be on the lookout for new industries moving into the area, but it should be aware of those which move out. Sometimes this happens very quickly. Smaller shops and plants have sometimes relocated before a Chamber of Commerce list can be distributed. A new industry will usually offer full and sometimes part-time employment for students in their chosen career area.

A reasonable knowledge of local industries will ensure an awareness of present and projected job availability, as well as major changes in the industry.

Local libraries will have annual industrial reports, planning proposals and possibly employment projections. Librarians are usually willing and resourceful participants in this type of research.

At a point to be determined by the instructor an ad hoc committee made up of a cross section of the industry, those school educators responsible or knowledgeable in this particular curriculum, state specialist(s) and others as needed, should meet to determine procedures and data needed to finalize the curriculum for recommendations for adoption to the policy board (Board of Trustees, Board of Education, etc.).

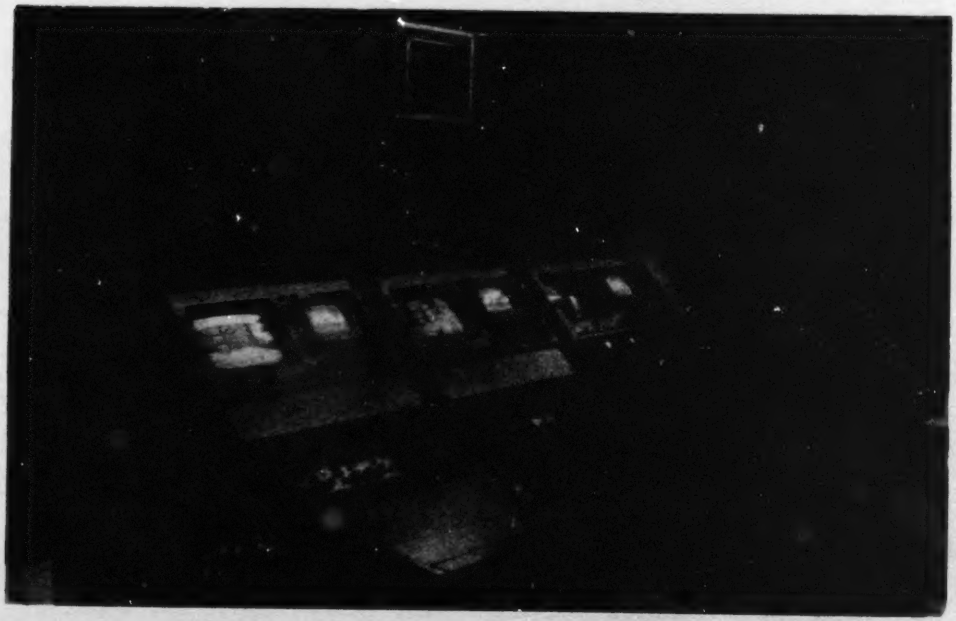
Ad hoc committee members should be carefully chosen so that their efforts will result in practical, integrated solutions acceptable to the industries, community, educators and students.

The ad hoc committee may have to meet several or more times before deciding that the curriculum should be recommended for adoption. Their primary consideration must be job opportunity followed closely by a local supply of candidates for the curriculum training.

If a consultant has been employed, his report and recommendations should be presented in person to the ad hoc committee. In this way, many valuable insights or suggestions can be incorporated into the curriculums which otherwise might be lost or overlooked.

It is strongly recommended that the consultant be a professional educator currently directing a successful and similar curriculum in another school or college. The bugs in his curriculum will have been detected and potential hurdles overcome before implementation of the proposed courses.

Jobs, industries and skilled technicians can and do relocate, but generally speaking, the training recruit must be found in his home area.



It is essential that a carefully planned public relations promotion plan be put into operation a year before the curriculum is offered to student applicants. The ad hoc committee should play an important part in this promotion. Someone preferably from a large corporation who is responsible for sales promotion would be a necessary member of the ad hoc committee.

(2) Now that a need for trained personnel for specific curriculum industries has been established (electromechanical technology has been selected as a demonstrative curriculum for this study, See Section XI), the school should develop a curriculum which insofar as can be ascertained is academically sound, meets the needs of local curriculum industries and can be properly supported by facilities, equipment and teachers.

Sufficient comparison should be made with similar selected curriculums in institutions where success and excellence are established.

The U. S. Office of Education, the American Technical Education Association, the American Vocational Association and other organizations which have relevance to the selected curriculum should be researched to find successful programs throughout the country.

Institutions must be visited and their course lists evaluated in the light of local requirements. Careful attention should be given to educational equipment, "hands-on" training time, and practical check-out lists.

Since the student's initial job will probably be a local one or one within commuting distance, the local curriculum should reflect local industrial needs. However, the student must be made aware of distant opportunities, particularly those for which the initial curriculum can provide a base.

For example, a mechanically-minded student interested in merchandising might look for a career in industrial sales. Or someone trained in basic technology might look to LASER, nuclear or fluid technology for career realization. Some of these job opportunities would necessitate relocation for the worker.

Therefore, an investigation of developmental or specialty careers based upon local offerings would be helpful.

Each course in the curriculum must include all items to be taught, arranged developmentally and sequentially, and giving attention to unified concepts with other courses as desired.

For technical courses, "hands-on" instruction should take up 75% of the student's class and laboratory time. For some, e.g., typewriting, welding, auto or diesel mechanics, drafting — it will be even more.

The instructor will, of course, allocate time as he thinks best, but talking and listening without "hands-on" laboratory experience will not develop skills.

The course outline should indicate where, when and how the student will be tested on his ability to handle the equipment, tools, etc. and provide for the correction of malfunctions and trouble shooting as desired.

In some curriculums it will be necessary to set up "simulated situations," that is, situations as close to what actually will happen on the job as possible.

This is especially true of management, merchandising, etc. These simulated or role-playing experiences can be augmented by observation trips to businesses or industries concerned.

Some personnel officers and supervisors have pointed out that the first time some students, with a great deal of training, have a glimpse of the real job is when they report for work. It is the instructor's responsibility to ensure adequate student familiarization with on-the-job work to show the student what he will be doing every day and the kind of work environment he may expect.

There must be sufficient equipment for all class members. A watcher is not a worker.

Those truly motivated towards a career will usually not be satisfied with minimal study and training - especially training. The laboratories will not all be similar to that provided by a certain New York State technical instructor who opens his lab at 7 a.m., eats a sandwich in the shop for lunch and who goes home only when his wife calls him late in the afternoon - BUT whose shop is filled with students all day long. These students are pushing back their horizons and developing their skills and knowledge far beyond the minimal requirement.

Students must have opportunities to develop their own ideas in addition to course requirements.

Providing these "shop" opportunities takes a skillful instructor who will keep his work benches occupied, his students enthusiastic and his laboratory fully utilized.

(3) Those instructors who will teach the support courses - English, mathematics, history, physics, et. al., should be asked to relate their teaching insofar as possible to the vocational goals and day-by-day work of their students and to use practical examples and problems in their teaching.

This too, should be "spelled out" in the course outlines.

Professor Marjorie Edwards of Montgomery College upon finding that she would be teaching vocational and technical students, spent many days learning technical terms, basic electricity and other relevant material.

"If a technician has to write a report, and most do, his effort or part of it might well be lost if he fails to communicate in clear, concise language."

Some colleges offer a course in technical history. It is inspiring to see the development of this country through the efforts of its workers and inventors; of its industrial progress and business development.

(4) In order to obtain the opinion of experts — those employed in the plants, it is essential to remember that time is of the essence. It is suggested that each course or module be capsulized on one page so that the selected, cooperating expert workman can quickly examine it and make suggestions.

During our interviewing process, supervisors, etc., were asked, often in a noisy shop, whether certain items and "hands-on" descriptions were pertinent, and what should be added or eliminated. Usually they were eager to give us this first hand information.

This has been said in an earlier section and must be re-emphasized — the men and women in industry whether they are workmen, technicians, supervisors, managers or others, proved to be willing to share their expertise far beyond anything we had hoped for.

While it is true that industry can find a selected source of partly trained labor funneled through the schools, it is very important that school personnel also realize that the "people employed" are generally eager to assist our young men and women find careers.

It will not be necessary to have every identified curriculum industry review the course outlines. It is suggested that the instructor choose from his established list those which he thinks are representative and progressing.

Careful consideration must be given to the nature of the curriculum and the related industries and government agencies.

The conclusion of a representative group of shop technicians, managers, supervisors, et. al. is that each course should be examined item by item including "hands-on" training, and that at least five and possibly seven agree upon the item, and its "hands-on" checkout procedure.

In the final analysis, the instructor must decide what shall be taught and what equipment purchased.

School laboratory equipment, both simulated and that found in the trade, will be discussed in Section X.

To achieve this curriculum evaluation, it is necessary for the instructor or someone equally knowledgeable in the curriculum, to personally visit selected shops and places of business.

Now having polished his curriculum with the grinding stone of realism of the pertinent industry, the instructor must ensure that his shop is in order, i.e., he has the tools and equipment installed in accord with his own judgment based upon suggestions from equipment specialists and his industrial partners.

It is essential to obtain sound judgments as to effective instructional equipment from experienced teachers, industry training instructors and technicians on the job.

If the instructor has pointed out what the school is trying to do, the need for assistance from the curriculum industry in planning and his true desire to learn from those who actually do the work — the instructor will have built up a group of interested, friendly, continuing consultants who will ensure his success in carrying out the mission of his institution and especially his curriculum.

Section III—Riding on the Growing Edge

I have called this section, "Riding on the Growing Edge" because no career program can remain vital and [illegible] consonance with the industry it purports to serve unless there is a systematic and continuous adaptation of the curriculum to the needs and development of the industry. The school represented by the instructor(s) must maintain its place on this growing edge through continuous school-industry interchange locally, an awareness of regional and national developments, and knowledge of integration or systemizing with other technologies in career fields. The instructor must also be on the lookout for revolutionary change which may quickly relegate what he is teaching toward obsolescence.

How then can this continuous updating be achieved?

First, the steps enumerated in Section II should be followed in greater depth.

In addition to the profile card, a folder can be set up for each industry, this to contain company information, plants in other states, annual reports, pictorial brochures, sales material, etc. These folders should be accessible to students in the curriculum shop area.

The profile card can be used for statistical data, e.g., number employed in curriculum areas, employment projections and needs, special skills sought by the company, upward mobility opportunities, pay scales and fringe benefits, opportunities for women. The company personnel officer will probably help in providing this information.

Probably the most important action to be taken by the instructor is his interchange with at least a large sampling of local curriculum industries on a systematic basis.

The number of industries with which he can maintain liaison depends upon the instructor. He must use his time and effort to suit those in the industries and he must be prepared for rebuffs -- which are temporary and can usually be overcome with persistence.

Having established relations with supervisors, personnel administrators and technicians by seeking their knowledge in developing the proposed teaching and laboratory work, it is essential to maintain updating. This visiting of representative industries should be done at least every six months to determine changes in skills required and production methods, newly developed equipment and instruments, and recommendations for curriculum change. The instructor can submit capsulized modules for rapid review.

At the review conference, forthcoming jobs and projections can be discussed; also immediate needs, cooperative jobs and how well the school's students are working out.

These interviews should follow a brief outline and results summarized on the profile card. Suggested curriculum changes can be noted on the capsulized module so that the instructor may identify trends upon which to make his judgments.

Twenty-four curriculum industries would require two visits to a company per month, a small effort to (1) build mutual confidence in the school-industry partnerships, (2) stay on top of a skilled job market and (3) keep the instructor on top of his job by enabling him to stay on the growing edge.

Since many students work full-time and attend part-time classes, visits to the industries will give the instructor an opportunity to strengthen the company-paid tuition plans. In addition, the instructor can gather data on former students as to curriculum effectiveness, upward mobility, and career development trends.

If the instructor does not set up a visiting plan and follow his schedule strictly, the updating will fail. The vocational teacher does not teach academic subjects — he prepares men and women for jobs. He must take the initiative in approaching business and industry to find out if the job openings are there and what training the companies will pay for.

In some cases, it may be possible for the instructor to call together a few personnel administrators to discuss the job market, or another group for curriculum considerations. These meetings can be conducted at the school where instruction, equipment and facilities can be observed or at a company or government agency. The main purpose is to encourage meaningful interfacing between the school and curriculum industries.

Schools, particularly community colleges, can often provide space for industrial seminars and meetings for relevant professional organizations.

READING MATERIALS AND VISUAL AIDS must be made available to students in the shop areas, backed up by items in the library collection. Relevant journals and periodicals selected by the instructor should be within easy reach. A shelf with manuals, trade books, texts should be available in the shop for checkout use.

Diagrams and other graphic illustrations can be displayed on a shop bulletin board. Cutaways, mock-ups and other visuals can be rotated as space permits.

Company sales materials and descriptive material including general employment information can also be made accessible.

In order to keep in contact with other instructors throughout the region and various parts of the country, it is necessary that the curriculum instructor attend relevant conferences and visit newly opened or outstanding educational facilities whenever possible.

Sometimes it is difficult to obtain the names of those responsible for teaching specific curriculums in high schools, community colleges, etc. throughout a state or region. A list of programs can usually be obtained from the state vocational division, from the U. S. Office of Education, from the American Association of Jr. Colleges and other sources. There are also published lists of private schools. It is very helpful to check with these since their existence is based upon training directly related to jobs.

Much has been said about job market predictions. Those of us who have tried to use only national, state and county data have found that something more is needed, i.e., a local prediction for specific skills. And this prediction is within reach of the instructor who will maintain a close relationship with the industries. Perhaps the time will come when "curriculum industries" will report needs for certain skills — this grass roots data applicable to the local student looking for a job.

Does this mean that national trends can be ignored? Of course not. Many of the local industries are national or even international. The mobility of the American labor force is well established. And there are and hopefully always will be opportunities over the horizon.

But a career start begins with one small job requiring some skilled training.

A great philosopher once said -- the only justification of an analysis is a proper synthesis. It is not possible to separate the skills, training and knowledge from the job.

Section IV—Mastery of Basic Skills Means a Job

The instructor's first responsibility is to his student — to help him find a job to achieve self-realization and an opportunity for upward mobility. Each student must embark on a program of aims peculiar to his own desires, abilities and needs. In his early work years, he will probably change jobs 3-5 times, not always for upward mobility; but always adding to his store of understanding, maturity and experience.

Most jobs — initial and changes of employment — are obtained by direct application to a company or government agency. It is the instructor's responsibility to show the applicant how to get a job in the technology or career field for which he has been or is being trained.

The resume is an effective instrument for those on a professional level but for those applying for "hands-on" and other career jobs, a different approach is necessary.

If a company is planning to hire new personnel, the applicant will first be confronted with an application form peculiar to the company. It is not acceptable to clip a prepared record of education, experience and skills to the form. I asked Richard Smith formerly of Hewlett-Packard, and currently Remac Corporation personnel administrator, to give us the benefit of his experience with this point and others. He agreed that many applicants have poor handwriting and that when the application form has been completed, it is illegible. But he pointed out that everyone can print legibly. It will take longer but a painstaking effort will usually ensure consideration.

The applicant should work under the direction of his instructor to summarize all the information about himself which may prove an asset to the target company. The applicant can refer to sample application forms provided by the instructor and collected recently from a sampling of curriculum industries.

A young person can list as assets, odd jobs, volunteer services, skills acquired; e.g., maintaining a household waterpump, a truck, etc. An older applicant will have more experience to offer and probably additional useable knowledge as well. But all should be directed to indicate what the applicant can do for the company and why he should be given the job in this technology or career field.

In his summary sheet, the applicant must be careful to accurately describe acquired skills. The statement should be checked by the instructor for accuracy and nomenclature.

Sometimes the instructor will be able to send over the summary sheet to the shop foreman if he is aware of an opening. For years it has been common, especially in high schools, for a vocational instructor to "let a company know" when he has a good candidate. Once the contact with the industry has been made, calls from the personnel officer or shop foreman are apt to occur frequently.

But the applicant must fill out the formal application whether he is recommended or walks in off the street. He should be prepared to spend as much time as needed: (1) to complete a neat application form based upon his summary sheet and indicating his qualifications for the job; and (2) to be prepared for all questions if he is granted an interview.

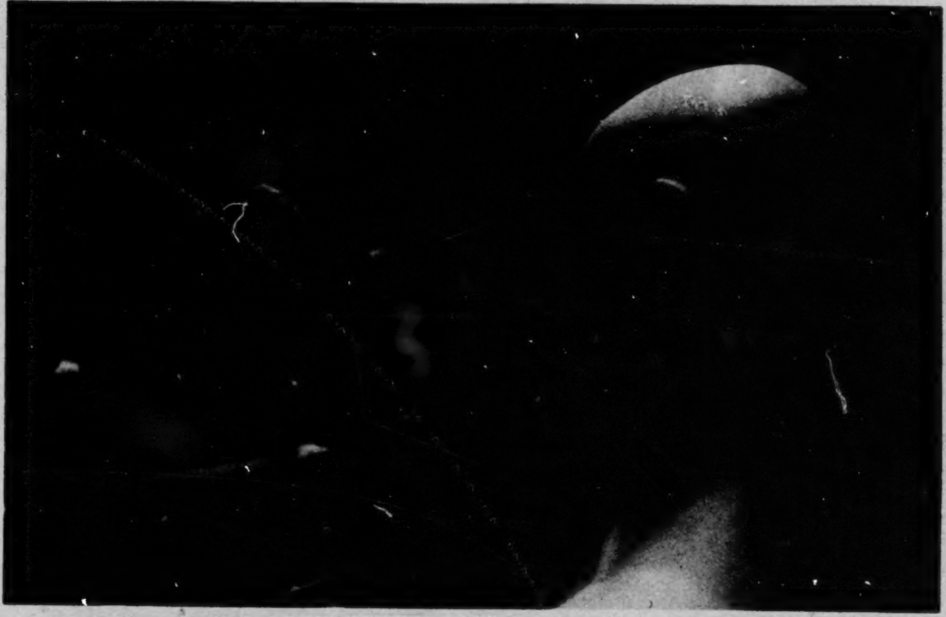
The instructor should from time to time set up practice interviews. Interspersed with these might be short presentations by personnel officers and supervisors from nearby industries. During the interview process, the applicant may be told to, "Tell me about yourself." This is a golden opportunity — if he is prepared. So he should say why he wants to work for this particular company, based upon all that information which he had studied with his instructor and which is on file in the school shop.

Sometimes a company for which the applicant wishes to work is "not hiring at present." But it may be possible to break through with a well-planned letter again emphasizing what the applicant thinks he can do for the company.

These techniques taught by the instructor will help the student all through his working life. If the student wishes to find a job in another part of the country, a well-planned letter may get him this opportunity. He must be able to accurately describe what skills he possesses and what he thinks he can do for the company. If he has back-up letters of recommendation, these will help.

A worker should try to get a letter of recommendation when he is leaving a company. The supervisor should emphasize specific accomplishments, i.e., "raised sales 32% in a three month period" or was "especially capable in trouble-shooting oscilloscopes."

Each time the worker applies for another position or when he thinks it advisable he should update his summary sheet to include skills learned. production or sales increased, commendations, promotions. He must include the names of references with job titles. Thus, the summary sheet will always be an up-to-date reference for filling out an application form or preparing for an interview. Of course additional schooling and training should be added as accomplished.



In most instances, according to this study, the ideal time to begin a career is as soon as enough skill(s) has been acquired to obtain a job in the student's chosen career field. This usually requires completion of a good high school vocational course or three technical "hands-on" courses in a community college or technical school. This enables the student to earn a full pay check and continue his training at his own pace after hours, often at company or government expense.

An older person wishing to improve his job skills or looking for a career change can also take after-work training. But a word of caution — the student should carefully consult with the instructor as to immediate and long-term job opportunities.

The full-time student enrolled in a post-secondary institution makes up roughly one-half of those in the curriculum. Some of these will find "co-op" opportunities through the instructor's efforts. However, most companies are very selective in regard to cooperative students since they are really looking for capable, full-time employees after the training period.

Most full-time career students work part-time at something. They should seek assistance from their instructor who may eventually get them placed in related work.

Today a work record is part of a worker's life and accessible to every employer. The worker must do as well as he can on the job and in improving himself. He should report for work every day, unless there is a very good reason not to; he should be on time; and should try strenuously to get along well with his supervisor and his fellow workers. The freedom to get another job is always possible for those who can and do perform well -- those who have good work records.

Section V—Train and Earn

Many of our young people - at 18 years of age and on - are achieving self support and self made decisions by obtaining jobs and beginning to shape a future. This is not a retrogressing to our earlier history when couples in their teens set out for the West but an emphasis upon what has always been true of the boy or girl who goes to work upon completion of high school or upon leaving school before graduation.

The high schools have always offered skills training to prepare graduates for jobs, but because of intellectual snobbery and strong parental desires for their children, many students have been diverted from this opportunity.

The old saying, "He who has a trade has an estate" might well be translated for today's world to, "He who has a saleable skill will be prepared to face the future with confidence because he has earning power."

Again and again, managers, supervisors and personnel officers have indicated their willingness to hire the trainee as soon as he can do the job. Almost without exception, the larger companies will pay tuition for technical, related and general education courses for their employees. The door is wide open for a full-time job with a future and competitive pay, opportunity for advancement and company supported education.

The Chinese Journey begins with the first step and one way to the "American Dream" (a dream which is healthy and functioning better than ever) begins with the first technical or vocational course.

It is the responsibility of the school to publicize the possibility of deferred tuition payments, loans and grants for the disadvantaged. Television advertising is very costly, but young people listen to certain radio stations — and these stations are usually willing to make short announcements.

In academically oriented high schools, sufficient information and guidance are seldom given to all students who could readily master vocational and technical skills.

One of the objectives of this study is to devise a method(s) of determining the point during a student's education and training when he is able to obtain employment.

In all probability, the beginning vocational student in a community college or technical institute will have achieved certain skills and knowledge to offer a potential employer. He might try immediately for a job in his field of interest and then plan a program with the company educational officer and the college instructor for after-work training.

Thus he will be able to earn full-time pay and acquire applicable skills and knowledge at the same time.

A full-time student might be enrolled in a cooperative program through the instructor's effort. Generally, the company concerned is usually willing — and this is fair — to accept only cooperative students who look exceptionally promising as future full-time employees.

Company and government agency apprenticeships are well established roads to skilled trades. For many years, the apprentice has occupied a favored place in American industry and in the labor unions. It is a golden opportunity.

For over a hundred years the American labor movement has been outstanding in its support of education generally and vocational training in particular. For those fortunate enough to be chosen as apprentices in the labor union trades, the opportunity for jobs, good pay and benefits are exceptional. In some instances the labor unions have been willing to entrust "related" education to the schools — a responsibility which should be sought by the schools and colleges.

Apprenticeships whether union, company or government agency sponsored, should be brought to the student's attention by the instructor. Further, they are "earn as you learn" possibilities.

In recent years, additional emphasis has been placed upon modular units, programmed instruction and a "break" in the semester lock-step.

A modular unit is usually considered a proportionate segment — say one credit hour — of a three credit course. This allows a student to select that part or parts of the course which he does not know sufficiently, without the boredom and waste of time of sitting through what he has already learned. This should be worked out with the instructor.

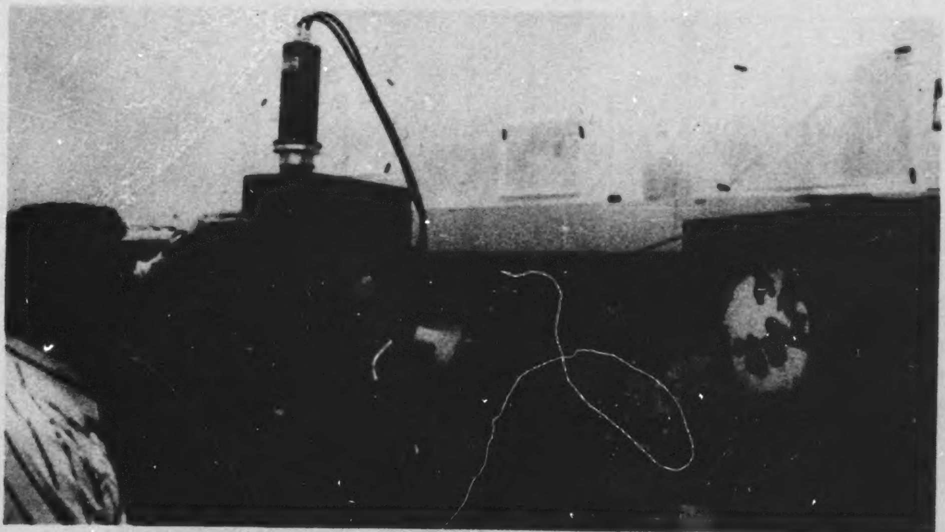
Programmed instruction — individualized self-paced learning — utilizing audio-visual tutorial methods or step-by-step page directions enables a student to capture the enthusiasm and motivation of immediate interests and needs. Today's instructors are particularly adept at directing and assisting in this kind of learning which enables a student to achieve in proportion to his own intermittent learning patterns and motivation.

The above and other learning adaptations, particularly of the "hands-on" type, allow for cyclical entry to training throughout the semester or year and again deviates from the lock-step of outmoded course patterns established a hundred years ago.

Most instructors strongly suggest that students, at the very beginning of their training, begin to plan individual projects of special interest to them and within the parameters of the course. These can be of real use, simulated, or experimental and apply to most vocational or technical courses, e.g., build a motor, hook up electrical-mechanical controls, fabricate a sales display plan, etc. Training in the use of hand tools, instruments, meters should precede use.

The technical specialties should be introduced at the beginning of the course.

All branches of the armed services offer opportunities to acquire knowledge and skills applicable to the civilian job market. In most instances, choices for training can be made at enlistment. Previous training in particular vocations will help the student gain entry to service schools and college training. For those who can qualify and who are willing to work under discipline, the reward is well worthwhile.



A somewhat large segment of our young people is classified by government criteria as disadvantaged. These disadvantaged can help supply labor needs if they are trained, but they must first be recruited. These untrained, young, healthy, ofttimes idle individuals constitute one of the major problems of our society; but trained for jobs they can achieve self-realization, steady pay and contribute to the nation's well-being.

It is suggested that a strenuous effort be made to help them obtain financial aid for the first technical course (and if needed, for the additional courses required for job entry); in other words, get them on the "Earn and Learn" track. A further discussion of recruiting methods will be found in Section IX.

The above discussion includes the opinions of many employed in industry and vocational-technical education, and points out the necessity of encouraging high school graduates, those who leave high school early and those enrolled in colleges or institutes, or so contemplating, to get a job as soon as they can qualify. The job should be in the student's chosen career field; if it is not, he should search out one that is and thus earn and learn in his job area.

Section VI—Experience and Previous Training Counts

There are many in our society who possess knowledge and skills which can be integrated into vocational training and thus shorten the time required for job entry.

However, this requires initiative on the school's part in establishing a method of incorporating such skills and knowledge into a curriculum and more important, a dissemination of pertinent information to potential students and working adults in the community. This "articulation" can include high school preparation, self-taught and correspondence study, on-the-job training, and military school training and experience.

Articulation may be defined as a planned process to enable students to move with continuity and without hindrance from one educational level to another, incorporating knowledge, skills and experience already gained. The vocational educator can extend this into job success and follow up.

Crediting high school courses or waiving college requirements by examination must be based upon the instructor's judgment; his reputation is involved as is his credibility with the industries to which he sends his students. Often high school instructors work closely with community colleges or technical institutes by ensuring that the courses are integrated and in a desirable sequence.

In some areas, secondary vocational centers are closely coordinated with nearby community colleges to the point of using each other's equipment, facilities and even instructors.

Cost analyses in colleges and supporting school systems based upon joint use of vocational facilities and equipment and careful attention to capital and operating costs might result in a combined effort beneficial to both secondary and post-secondary levels.

The major objective should be to provide the student with a smooth flow of vocational training from his early high school years through post-secondary.

Self-taught knowledge and skills are difficult to evaluate unless they can be assembled to coincide with courses or modules in the curriculum. Correspondence courses are usually completed by sections, units, etc. and are more readily assessed.

Also, allied or complementary skills will reinforce what the student is learning -- no vocational skill or knowledge is lost.

Although this study is concerned with the parameters of one curriculum at a time, it is fair to say that a diversity of vocational curriculums and courses should be offered by every community college to meet needs and demands of students, parents and employers. A board of trustees, college officials and an advisory committee should consider the total vocational programs needed and articulation with secondary programs.

Today many public school systems are encouraging students, regardless of their long-range educational goals, to graduate with a marketable skill. Certainly, the community college student enrolled in transfer or general education should consider a similar course of action by acquiring vocational electives.

College vocational coordinators and instructors might encourage vertical planning say, from the 11th grade in high school through the college associate degree, by working with the high school counselors and especially the instructors. Periodic discussions and planning involving teachers on both levels would eliminate the relative isolation of educational institutions now existing except for an annual assessment for transfer. According to secondary personnel interviewed, they would welcome a coordinated effort on behalf of their students. This would go far toward the early establishment of student vocational goals, the elimination of duplication in training and earlier achievement of job entry.

Although many students will obtain or transfer to jobs at distant locations, the close liaison of the instructor with nearby curriculum industries will enable him to establish a continuous data base from which evaluation conclusions may be drawn.

A very effective means of achieving articulation is that of advanced placement. Today many high school seniors and even a few juniors carry light academic loads. College recruitment of these students -- whether they are college bound or not -- is advisable. This would help provide continuity for their educational programs and in the case of career-minded students, would enable them to begin training for jobs a year earlier, or stimulate a desire for advanced education.

Thus, at a time when many high school students are relaxing their efforts, these advance placement candidates can increase their knowledge and sustain their enthusiasm for future planning.

Section VII—General Education and Library Resources

The basic freshman English courses offered in colleges across America are the minimum which should be required of every student. Unfortunately many have become stereotyped with the requirement for a freshman "research" paper and selected readings. Students do not always know why they shy away from certain courses but their judgment is usually sound.

The English required to obtain a job is practical and related to the world of work with emphasis upon the technology in which the student is enrolled. This can be accomplished in one semester according to Professor Marjorie Edwards. This is not to say that further courses in writing and literature are undesirable; but for job entry and job getting, a student must know how to write reports, applications, analysis in his chosen field; and he should also be able to write acceptable communications - letters, memoranda, etc.

Having mastered a course in technical, applied, general or whatever English needed to keep his technical/vocational job, the student should then study writing and literature in whatever vein or direction he chooses and as soon as he is ready.

The student must learn to read the literature of his trade -- manuals, journals, periodicals and books.

Again and again industrial and business representatives stressed the need for reading ability to understand complex manuals, ability to write reports which can be understood -- in other words, communications skills.

Hopefully, the student will find a teacher along the way who will inspire him to read in the great distillation of human experience, good literature. But this is not necessary to get a job.

Now as to mathematics. A preponderance of vocational and technical requirements for job entry is met by a thorough knowledge of our old stand-by, arithmetic. For the study of most technology, add elementary algebra. In other words -- you guessed it -- high school mathematics.

For the more advanced technologies such as electronics, additional mathematics would be desirable.

Today we find an increasing number of high schools offering introductory courses in analytical geometry and the calculus. Unfortunately, those students who may later study an advanced technical curriculum are seldom steered into these courses which are usually reserved for the college-bound. Certainly, those responsible for secondary - post-secondary articulation should suggest making advanced high school mathematics available to vocational students.

It has been well established that emerging educational change lags far behind industrial and business advances. Although it is true that fundamental principles in the physical and other sciences do not change, applications of these principles far outstrip the understanding of those who have accumulated such fundamental knowledge.

I submit that those who have studied physics will have a far better understanding of the subject by applying this knowledge to current needs. An outstanding scientist and engineer for whom I worked in a large corporation told me that he gained most of his knowledge by working in the shops and practical laboratories — an inductive process.

The head of the General Electric Research Laboratory and subsequent department head in a large university worked his way up from a laboring job by "steadily interfacing his shop knowledge and skill with the book learning" in his night courses. He further stated that he would have been a mediocre supervisor if he had not discovered the importance of dirty hands and work as applied directly to the principles of physics.

When the scientists who were to form the Royal Society met in 1642, they were concerned with the application of scientific principles to problems of that day. Later the academic community adopted the sciences and relegated them to the liberal arts curriculum.

Certainly, a fundamental purpose of science is to apply the knowledge which has been gained through research and development -- but the accumulation of scientific knowledge developed by those working every day must also be utilized.

The wise teacher will continue to drive home the idea that "Chance favors the prepared mind." Each student must be encouraged to establish his own vocational goals -- to keep them flexible and adaptive to our changing industries. Technical skills and knowledge in our technological society provide a good start for a rewarding future.

It is essential that sufficient reference books, trade publications, statistical information and other published materials be available in the school library to students enrolled in each of the vocational curriculums. The librarian must update, add pertinent publications, and consult with instructors as to what is wanted, on a systematic basis. Relevant audio visual materials should be acquired after consultation with the instructors.

The larger businesses usually have their own libraries and employ technical librarians who are willing to suggest sources of information and furnish materials to be filed in the school library or displayed in the curriculum laboratory. This source should not be overlooked because it is absolutely necessary that the industries keep abreast of their specific fields; knowledge of the industries where students hope to work will enable them to be better prepared.

Most teachers and librarians will agree that vocational students are not frequently found in the library. But relevant books and materials which are current and thereby interest-evoking and motivated by the instructor's library assignments may help establish the "library" habit.

Placing a dozen or so books and trade journals in the student's shop will help -- particularly if they are available and pertinent to the work under study.

Necessary operational and repair manuals must be available in the shop. But whatever, the curriculum journals, periodicals, references, and trade publications, etc. should be available where the students are being taught.

Section VIII—Untapped and Upward Mobility Resources

Despite the agitations of Women's Lib, women remain one of the disadvantaged in the various groups which comprise the available work force, except for certain "woman oriented" occupations, e.g., secretarial, account clerks, merchandising.

It is a category in which it is no longer practical or feasible for them to remain. Since time immemorial, woman has been the mainstay of the housefold, the nurturer of the young, the provider of nourishment and clothing for the family unit, and the source of its spiritual life.

Today, with the average life span doubled or even tripled, the subordinate role of aider and abettor of the male is no longer valid: there are simply too many women who have no men to provide them with the financial support necessary to keep the status quo. An average life span of 75 years for women (73 for men) no longer permits a woman to devote all her attention to the rearing of children - that takes roughly about 20 years - a chore which required her ofttimes to be teacher, doctor, nurse, cook, seamstress, etc.

She still does all this to some degree and more, but modern technology has lightened the burden somewhat: education in the schools, physicians and surgeons in hospitals, supermarket shopping and ready-to-wear clothes on the rack.

In these inflationary times, a second source of income is all too often a necessity not a luxury in many households. In others, a single parent is the sole support. The old argument of "women belong in the home" is passing into a well-deserved limbo.

Women in the work force are here to stay and their contribution cannot and should not be denied. This source of labor is needed, along with that of the handicapped and others, a fact which has become more and more apparent to corporations and industry.

Where then is the major block? It lies in the macho attitudes of the male work force, both middle management and skilled worker against female workers and in the refusal to accommodate to the disadvantages suffered by women.

What are the disadvantages borne by women workers? They are:

Physiology - women do not have the stamina of men, or their strength. Women libbers notwithstanding, no employer in his right mind will hire a woman in a job where strength and stamina is a major factor in performance. A more realistic assessment of job skills required for a desired job would eliminate much criticism and/or derision when females approach a prospective employer.

Home situtation - for the most part, women cannot leave children to a wife as men do. Once her 8-hour shift is over, a woman comes home to a second 8-hour shift of cooking, cleaning and tending to her family. There is a growing trend toward males sharing in this household labor, but the effect is minimal. In the event of illness in the home, whether in husband or child, the female is the one called to the rescue. No man is required to stay home from work because his wife or child is sick. Time studies, which reflect men's performances, show that women with husbands and/or children come to a job more depleted, less strong and less enduring. However, this does not pertain to technical jobs which require mental skills rather than physical prowess. Housework, although strenuous, does not overtax the mind.

The 7-day week - some will say that this is properly a physiology point. But they are the ones who will argue for the need for relaxation and recreation for men after a 40-60 hour week. Women work on Saturdays and Sundays - 3 meals (and countless snacks) are inexorable in their regularity and the laundry mounts visibly day by day. Repairs around the house, in contrast, are generally seasonal and can often be postponed to a more convenient time. Not so with housework.

Hostility on job - the general attitude is still "Why aren't you home taking care of your kids and your husband?" although the evidence shows that women are working because of real economic necessity. Men are secretly fearful that women are replacing them in jobs although both sexes are needed in the work force. Their fear is manifested as deliberately rough talk (ofttimes rougher than normal) and reluctance to initiate women workers into the small tricks of the trade which make work life more endurable. Supervisors, anxious to remain on good terms with men workers, tend to favor men in the distribution of labor and in nearly every facet of life on the job.

The rotating shift - because of her home responsibilities, a woman is less able to juggle her hours around the clock. The difficulties of rounding up a baby sitter on a less-than-regular basis often preclude the young (or even not-so-young) worker from accepting a rotating shift job. This also extends to women whose children need supervision or husbands who demand their wives' company during their leisure hours. An added factor is the obvious dangers which these women face going to and leaving from the 4-12 and 12-8 shifts.

Attitude of women - this is a major hurdle. After lifelong indoctrination through books, newspapers, movies and television, women look for jobs with glamour and cosmetic appeal neglecting the financial rewards of a technological job. Certain jobs and certain attitudes are labeled "unfeminine" and omni-present propaganda bombards women with the dire consequences of being unfeminine.

For example, there are few women engineers and since technicians seem to go hand-in-hand with the engineering professions, it follows that a large share of the technical jobs go to men.

Recommendations - since there appears to be little or no discrimination by industry against promoting women in technological pursuits (our research shows that companies are anxious to employ women in small assembly work and are sensitive to the lack of women technicians in the D. C. metropolitan area) women need to make a more realistic approach to the problem of earning a living. The employers we contacted are eager to employ women and are anxious to give them a chance to perform on technical, career and even decision-making levels, but the women themselves do not present themselves in sufficient numbers.

In one regard, the firms themselves should indoctrinate their supervisors and foremen that women are in technical jobs to stay - they are not taking men's jobs away from them. These same supervisors should be trained to cope with women workers - they are on the scene and responsible for production, not male supremacy. Time studies geared to male performance are no longer valid. Women can and do produce as much as men, but the pace is different. Menstrual absences and slow-downs are greatly exaggerated and these are more than offset by male hangover absences and slow-downs.

If women are going to obtain jobs now held chiefly by men and requiring certain skills, they too must learn the required knowledge and skills. It is the responsibility of the school, college, institute to carry out an effective recruiting program -- not just by publishing a catalog, brochures and an annual newspaper advertisement. The school must initiate a sales campaign with telephone and door-to-door follow-up. This is necessary to overcome initial inertia. As the enrollment increases, so will an appreciable momentum brought about by word of mouth and "success."

Can the instructor become a salesman, i.e., a salesperson? He must -- it means his bread and butter.

More and more we are finding women in America moving into jobs previously held only by men. This is sometimes looked upon

by women as a means to achieve the higher salary levels paid men. The study examines policies of corporations and small businesses relating to employment of women as technicians, et. al.

New laws affecting the handicapped and the steady improvement in opportunities by corporations and businesses have opened doors hitherto unavailable. Understanding has been dawning that this is a source of labor needed by our society and that many handicapped workers can produce on a level equal to the average citizen.

Here too it is necessary to mount a sales campaign, but there exist agencies and laws to help. Counties and cities fund organizations to assist the handicapped. Shelters are already training these men and women in basic skills. Federal agencies have pioneered in many experiments to provide jobs for the handicapped.

Disadvantaged youth must get a start when they are in their late teens or early twenties. Vocational training will enable them to contribute to the national well-being, but more importantly to their own careers. Here as in most endeavors, "Aller Anfang ist schwer," -- "every beginning is difficult." The educational institution must recruit these young people on time.

One of the major blocks to the disadvantaged is lack of money. Perhaps the first two or three vocational courses should be "free." If the educational institution has done its work of building liaison with curriculum industries, a job would be attainable after initial training and the student could maintain his inertia with employment and subsequent education paid for by himself and often supplemented by the company.

Section IX—Student Recruitment

Characteristics of candidates suitable for vocational or technical training are not always easy to identify, but we are certain that many are not adequately served by traditional academic programs. Basic secondary courses which provide skills training in hand and power tools, elementary electricity, fabrication of materials, mechanical drawing are very helpful to those who go to work at 18 or so or who enroll in community college or technical institute programs. Much of this training can be articulated into advanced study and thus reduce time for job entry.

But the first objective must be to enroll the student; and to enroll him, he must not only be made aware of the program, but he must be motivated to sign up. Very often, the guidance counselor is prejudiced to steering the student toward general education and other college curriculums. Some attention is given to providing information about career programs, but usually only for the "lower" academic level students. And the counseling effort is often desultory and provided by counselors who have negligible knowledge of vocational training.

For many years, high school officials have talked about hiring vocationally knowledgeable counselors, but this seldom happens. A possible solution is to combine counselor efforts with counseling responsibility by the teacher. High schools have been quite willing to make counselors out of general education teachers; seldom do they so treat "shop" teachers who could identify young men and women with potential vocational abilities.

During the course of this study, we have found that the vocational teacher on the secondary or post-secondary levels to be anxious to interview students before they select a curriculum preference, but invariably the vocational teacher's first contact with his student is after he has been selected and advised. A great proportion of students are never told about a future in the vocational areas and never get the benefit of vocational guidance by a knowledgeable vocational person.

In all fairness to the counselors, most are not aware of vocational opportunities. A partial solution is the training and exposure of general counselors in the "job entry" program requirements and opportunities.

All should be aware of the necessity that every student acquire a saleable skill - this can be done through electives and would take nothing away from college preparation and transfer. Resulting confidence of the student in knowing his ability to survive through a saleable skill will make for a better citizenry and a stronger society.

For some reason, colleges and high schools are reluctant to advertise their curriculum opportunities. A list of course offerings, sometimes brochures placed in libraries and college catalogs provide the sum total of their efforts.

This is not enough.

Schools and community colleges must be prepared to spend money for a planned advertising campaign. There are advisory committees for everything except curriculum sales promotion, yet men and women working in public relations would usually assist in establishing a policy to be followed by the school's effort.

At any rate, it is the school's responsibility to utilize whatever is available - slide presentations, newspapers, radio, television, door-to-door follow-up, mail campaigns to sell a product - vocational training - which is far more valuable than soap and cereal. Vocational school personnel must be largely responsible for content, timing and follow-up; and also for essential secondary, post-secondary articulation. Money spent for this purpose during the weeks prior to school opening is a wise investment - when knowledgeable personnel can be made available to do the job.

Each community, each college, each vocational secondary school - will develop its own methods relating to its clientele. But the school must evolve a will to sell this product in which it believes - vocational training for job entry.

If the school truly believes that women and the disadvantaged can be sufficiently trained to get jobs in a specific curriculum, a special effort must be made to tell them so - and to point out future successes and upward mobility. Most industrial companies sincerely welcome applications from women and the disadvantaged, including the handicapped.

As described above, the instructor's close relationships with personnel administrators, supervisors, etc. will provide opportunities for recommendation and employment. He will be aware of special training needs within the organizations, agencies and the private sector.

Most county and city governments are funded, Federally or locally, to assist in the training and job entry of the disadvantaged. The school should make contact with the proper agency to recruit students and assist in obtaining financial aid.

The instructor's close liaison with industry and government agencies will bring forth requests for special, modular and full-course training - at the college, the plant, the agency and the vocational school. This will enable the employer to encourage his employees to improve their abilities and upward mobility.

Student recruitment goes beyond merely enrolling an individual. It should include a continuous interest, usually by the instructor in promoting the student's future to the point where he has obtained a job. Even after the job has been attained, the instructor, with the company training officer and the employed student's supervisor, should continue to assist the student-employee in developing further career goals.

Follow-up and obtaining suggestions from these students with experience on the job will reveal additional items to be incorporated into the training programs.

Although industry is not particularly interested in foreign language, history, literature, etc. - as an educator, I must strongly suggest enrollment whenever possible in those "liberal" courses because of what they may do for the individual's intellectual well-being as a person.

And finally, student recruitment is a year long process, almost a missionary endeavor. Vocational directors, coordinators, counselors and particularly instructors must strive continuously to point out what their training will do for the individual and for business and industry.

Some colleges and technical institutes have been successful in announcing a counseling and registration day through the local press and other media. Present at this session -- usually held on a Saturday -- are specialized instructors in the various vocations and technologies, ready to assist, advise and possibly show the student the laboratory-shop in which he would be trained.

Some have presented slide pictures accompanied by vocal descriptions of instruction, actual working situations in local industries, and upward mobility possibilities.

This kind of session might also be presented at local high schools in conjunction with the efforts of school counselors.

The slide shows could be used as spin-offs at shopping centers and other places where the incidence of people traffic is high.

Section X—Computer Knowledge; Metric

Computer Knowledge

Computers have become an American way of life. Since the advent of the transistor and more recently the integrated circuit, the computer has continued to infiltrate every facet of life in the United States to varying degrees.

Evidence of the above manifests itself in many ways. Billing by the large utility companies has been done by computer for a number of years. Objective-type tests, such as driver's license testing, are often graded by computer. Dunning notices are often done automatically by computer when debts are not paid on time. All types of banking transactions are now accomplished in this fashion.

These are but a few examples. The list is endless. The housewife goes to the supermarket, armed with a hand calculator, to insure that she is getting a fair shake on so-called bargain items. She is met at the checkout counter by a device that optically reads data cleverly coded on packaged merchandise. It is fed into a computer which prints a listing of her total order with total cost, unit cost and other pertinent information she has painstakingly gathered while shopping. These optical readers are just beginning to be seen in large numbers at the supermarkets. These are just additional examples of how computers continue to creep into everyday life.

What does it all mean? Aside from the social and liberty restricting implication of the computer it means that they are probably here to stay and it would certainly be advantageous to anyone pursuing a career to learn a little about their capabilities and limitations. This is true whether the pursued career be merchandising, technically oriented or the insurance business. All careers are affected by their rapid emergence. This is stated without qualification.

People generally associate computer knowledge with a knowledge of mathematics. This is true but only to a limited extent. It can be experientially demonstrated that this is not so. Case after case exists where a person not well grounded in mathematics has proven to be an excellent computer programmer or systems analyst.

This point should be made explicitly clear to incoming students. In general, new college students have an intrinsic fear of mathematics. If they mistakenly identify computers with mathematics this fear is unjustifiably transfered to computers. This would be indeed unfortunate. A working knowledge of computers for anyone embarking upon a career cannot help but be an extremely valuable asset today.

Metric

A subject that is going to receive more and more attention over the years ahead is conversion to the metric system. Although at this point in time the U. S. has made no formal commitment to convert to the more practical metric system, a great deal of voluntary activity is taking place. An increase in the pace of this activity is expected until the turn of the century. At that time the majority of the measurement activity will be in the metric system.

Persons pursuing careers will be affected by this conversion to varying degrees. Those pursuing technical careers will be probably the most affected. Tools now in use will become obsolete because they will not fit the metrically designed equipment. Those in non-technical career programs, such as merchandising, are impacted less by a conversion; but a requirement does exist for a certain amount of dexterity in converting between the English and metric systems. Even in career programs that require little knowledge of the metric system, a practical understanding of it will not go to waste. Everyday phrases, such as; "... five miles to Centerville," or "... two pounds of hamburger," or "... a quart of milk" will give way to phrases like, "... eight kilometers to Centerville," and "... one kilogram of hamburger," and "... a liter of milk."

The adopting of the metric system is not only the ability to convert from English to metric. This is really trivial. The key will be to "think metric." This is an overused phrase but it adequately describes the need.

Section XI—An Electromechanical Technology Model

The purpose of this section is to describe the actual process that was used to develop the Electromechanical Technology Curriculum for Montgomery College.

To accomplish the above, the following criteria had to be met: the curriculum must meet the current needs of industry, a method must be developed to keep the curriculum up-to-date and the curriculum must be such that it ensure job opportunity as soon as the student becomes employable.

In order to develop a curriculum to meet the stated objectives it was first determined that a definable segment of industry be identified. Then using this segment develop a methodology for formulating a curriculum which could be applied to the other segments of industry. This was a formidable task since the breadth of industry, even within a community in the vicinity of Montgomery College, is so diverse. The task was further complicated by the fact the curriculum being developed would be identified with one of three campuses of Montgomery College, the community institution serving Montgomery County. Economic consideration precludes major duplication of curricula among campuses.

The discipline chosen was Electromechanical Technology (EMT). Considerable ground work was done by outside sources, especially the Federal Government, in leading to this selection. Briefly, the Department of Health, Education and Welfare (HEW) sponsored a grant in which, over a number of years, it was determined that EMT-trained personnel would come increasingly in demand. The study went considerably further than that and in attempting to briefly describe the effort put forth and the results thereof a certain risk of understating the grant's accomplishments is unavoidable. Aware of that risk, an attempt will be made.

In addition to determining that EMT would be a field in which the demand for technicians would increase over the years, the grant group proceeded to design a curriculum that could be used to train community college students for entry into the technology. This, of course, followed a period of extensive study that ended with the selection of EMT. The development of the curriculum involved extensive interplay with leaders of industry at all levels. This insured that the needs of industry remained foremost during development.

One of the difficulties encountered during the original study was to design a curriculum that would adequately cover the required subject matter in four conventional semesters. One of the techniques used to overcome this difficulty was the incorporation of the unified concepts idea. This system of instruction is based on the fact that technical studies are grounded in a few technical principles that apply across several technologies. This allowed the principle of reinforcement so successfully used in education to be applied while moving from one field to another. It also shortened learning process time and allowed the same amount of material to be covered in less time. In the original study the project formulated a list of Unified Concepts. These were:

1. Differential Forces
2. Flow Rates
3. Real Opposition
4. Energy Storage
5. Time Constants
6. Impedances
7. Resonance
8. Waves and Fields
9. Amplification
10. Feedback and Stability

These concepts were used as a basis for developing all science and technology courses for the curriculum.

Using these concepts, the staff, with the curriculum designed earlier, proceeded to develop the laboratory texts, instructor's data guides and other materials outlined in Attachment B. The curriculum itself is in Attachment A.

This is a very brief description of the background under which Montgomery College decided to adopt Electromechanical Technology. Electromechanical devices have become so ubiquitous

to American society that the general feeling emerged that a wise choice had been made. It is difficult to think of an industry, a business or an organization that does not utilize some sort of electromechanical device. Even the housewife has her electric can opener or electric knife, perfect examples of small electromechanical devices. Charitable organizations have their duplicating machines, butchers their electric meat slicers. Children have their electric trains.

All these devices, no matter how clever the manufacturing techniques used to produce them or how sophisticated the quality control procedures, eventually break down. Hence, the demand for personnel knowledgeable in Electromechanical Technology. The purpose of developing the curriculum is to attract students to this apparently wide open field. A field being lucrative is no assurance that a curriculum offered in it will attract students. This has been a common mistake at numerous schools. The curriculum must have appeal and must be sold for students to accept it. It was decided to make as wise a selection as possible using existing information, make the curriculum responsive to the needs of local industry through continual liaison and the curriculum would sell itself.

It was intuitively felt from the beginning that for a program in EMT to be successful, a close relationship must be established between the corresponding industries' key personnel and the EMT instruction staff. As a result, one of the first steps taken was to compile a list of industrial or governmental agencies likely to be engaged in EMT activity. Various sources for identifying these organizations were investigated. The sources for any particular area are probably the best for only that area. Obvious sources are the yellow pages of the telephone book, contact with the Chamber of Commerce, contact with professional organizations that maintain lists, vendors and the like.

As it turned out, the best source for this particular endeavor was a combination of the Chamber of Commerce business directory and the telephone company yellow pages. The business directory categorized the various businesses, making this phase of the effort very convenient. Even the latest editions of the business directory's listings, however, were slightly out-of-date; so the yellow pages were used to verify addresses and telephone numbers.

The best method of compiling the list will vary from locale to locale. A little ingenuity plus a certain amount of trial and error should be all the tools needed to develop a list of industries for any given area.

Having established the list of industries for the area being considered, the next step was to develop the curriculum. A number of methods was considered; start from scratch, consult with industries on the list and try to develop a consensus curriculum, and among still others using the Technical Education Research Center's (TERC) EMT curriculum as a jumping off point.

Starting from scratch had a certain amount of appeal. It appeared advantageous from the standpoint that it could be designed specifically for the local EMT industries. The big disadvantage was that it required the most time to accomplish.

Developing a consensus curriculum from industry's recommendations would also be time consuming. It would most certainly be appealing to industry. These two approaches were abandoned in favor of the third, using the TERC EMT curriculum as a jumping off point. This decision was not made without considerable thought. The TERC curriculum was the result of effort by leaders in education and industry. It was not produced in haste, being the result of extensive research in both time and money and thoughtfully conceived.

Although it was developed for a larger area than the one being considered here, it was felt that it covered no more of a diverse industrial group. It was further felt that an EMT curriculum developed by any group would have certain essential elements that would be the same. The overriding factor that led to the approach of using the TERC developed curriculum was that it allowed more time to be spent on the survey portion of the effort. This effort will be described later.

The basic curriculum developed by the TERC research staff was reviewed and modified to meet the needs, as best could be determined at this point, of the local community and the academic restrictions and requirements of Montgomery College. Additional modification resulted from contact with and advice from numerous institutions that were offering an EMT or closely related curriculum. It was felt that a more conventional physics course be offered rather than the physics course recommended by the TERC staff which consisted solely of a semester of Fluids and a semester of Optics.

Other than the non-technical courses and the calculus, the curriculum was essentially that recommended by TERC. Omitting calculus from a technical curriculum might be questioned in some circles. It has evoked much discussion. Calculus, no doubt, is a powerful mathematical tool and extremely useful to the understanding of many scientific and engineering principles.

Unfortunately, it has a reputation for being some mysterious system used by mathematicians and scientists in their never ending search for knowledge and truth.

This opinion is shared only by those who have had no exposure to it and are, therefore, in awe of it. Even some engineers hope they never encounter it again after their college years. Quite a few never do. And that is the point. If engineers can get along without it and still be fairly respectable engineers, certainly technicians can also, except for certain technologies such as electronics which require its use in study more than others. It was felt that an Electromechanical Technology curriculum could be successful without it as a required course, although a student could still take it as an elective. There were other reasons for not including it besides the one above outlined. The most important one is that it would make the curriculum more appealing to a broader range and draw more students.

With the unified concepts idea and a prototype curriculum with which to work, the most important and also the most time consuming part of developing a final curriculum could begin. This was to contact industry to get input on modifying, changing or providing general recommendations to the curriculum to best meet the needs of industry in the area.

A number of methods was considered to accomplish this contact. One was through the mails using a form survey. Another considered was a telephone survey. A third was to go to each industry on the list and personally interview key personnel at their offices or shops or whatever the case might be. Since this was unanimously recognized as being the most important phase of the work, it was decided to carefully review the objectives and attempt to determine which method of contact would best add to accomplishment of these objectives.

The form survey was fast but all recipients probably would not respond. The telephone survey was also fast but was considered probably the most annoying to the person being surveyed. Although you cannot throw a telephone survey in the wastebasket, it is certain some people wish they could. It is less distasteful to throw a form away than to hang up the telephone on someone.

The personal interview with key personnel could accomplish everything the form survey or telephone survey could accomplish and had the additional advantage of not being as rigid as either. It allowed a freer exchange of information. It had the tremendous disadvantage of being extremely time consuming and expensive.

There were other advantages to the personal interview not so readily apparent. As mentioned earlier, a close relationship must be established and maintained between industry's key personnel and the EMT instructional staff for the success of the program. What better way to initially establish this relationship than through the personal interview?

Fully aware of the disadvantage of the time and money involved the personal interview was selected as the method to conduct the survey. Because of the reasoning involved, the survey took on a much broader significance than a simple survey. Although the idea of personal contact with local industrial EMT employers was in the minds of the researchers from the start, the specific idea of using the survey as a vehicle for attainment of this contact really developed somewhere after the start. Instead of merely interviewing industry to get its ideas on what the curriculum should or should not contain, the interview was conducted with the idea that this would be the first of many meetings and discussions between the instructional staff and these key personnel. Industry was informed of the instructional staff's intentions and specifically queried as to any objections.

In no case did they object. A very high percentage in fact was extremely enthusiastic about the program, offered their support and in a few cases stated they would send students to the opening classes. One stated he would send his two sons. As it turned out, the few industries that did not enthusiastically respond should never have been included on the list in the first place. The company titles were really misnomers and mistakenly identified as part of the EMT field.

The survey form went through several designs and modifications before finally being adopted. At first and prior to the idea of using the interview to establish initial industrial contact, the form was lengthy and rigid, three pages with very specific questions. It was not until the interviews actually began that it became apparent that the form was inadequate. The rigidity of the form stifled the free flow of discussions. Its length made the interview boring. The lesson, however, was learned rapidly. After a very few interviews it was decided to redesign the form. The second attempt was a big improvement over the first in that it consisted of one page with key questions retained and less important ones eliminated. It too suffered, however to a lesser degree, from the same faults as the first design. Essentially, it stifled discussion and hindered attaining a very important objective of the effort, establishment of a close relationship between the instructional staff and the key representatives of the local EMT related industries.

It was decided to re-think the interview portion of the effort. What was needed was a format or procedure for conducting the interview that would encourage discussion and the flow of industries' ideas to be incorporated into the program. Less emphasis would be placed on the survey form itself. Instead, the form would be used as a guide to conduct a free flowing interview. Certain areas such as those covered by the initial three page questionnaire would still be covered, but the rigidity would be done away with, thus making the interview more comfortable and less boring. This resulted in the interview being the vehicle for establishment of a close relationship between the instructional staff and the industries' representatives.

The interviews themselves proved to be most interesting. Armed with a copy of the curriculum, consisting of course descriptions, course outlines and objectives, the interviews began with three basic questions to be answered: Does the curriculum meet the current needs of industry? What is the best way to keep the curriculum current? and, How is job opportunity ensured as soon as the student becomes employable? These questions, of course, beg other questions. A yes or no answer to the first question begs the following questions respectively: What can be done to improve it? and, In what way does it not meet the needs? This stimulates discussion, exactly the result desired. It is interesting to note, however, that none of the industries interviewed answered no to the first question.

In preparing for the interviews, prospective companies or organizations were sent a copy of the curriculum which listed course titles by semester, course descriptions, course outlines and objectives. The idea was to give the persons to be interviewed a chance to look over the course material prior to the interview itself. For various reasons this did not work out very well. For the larger companies, the material in most cases never found its way to the hands of the person to be interviewed. For the smaller companies, it got to the right person in most cases but most often it had not been reviewed yet. Although the idea needed quite a bit of improvement, it was not abandoned because it did serve as an introduction and a starting point in the discussion.

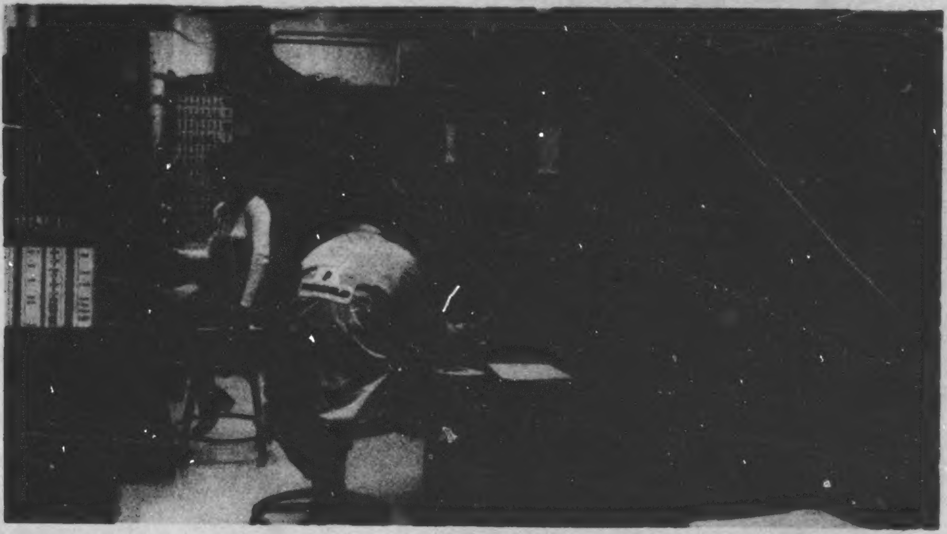
After the letters and course materials were sent out, the prospective companies were called to set up interviews during the next few days.

Unqualifiedly, all the interviews were cordial. Typical comments were, "This should have been done years ago." "A most useful curriculum." and, "I'll take five!" (Meaning graduates.)

All the companies were asked if any post-secondary school had personally contacted them at any time in the past. It is interesting that only a few responded that they had received form surveys by mail. Another few said they had visited local schools on days they had "open house." None had been visited at their office or plant.

It seems strange that institutions which are supported by public funds for the most part and some that are in existence solely to serve the community have a rather superficial relationship with respect to industry. This is especially true of middle and small size companies. The corporate giants surely are contacted at the highest levels but it is doubtful that this results directly in getting the "little guys" jobs.

Of course, this could be turned around and made an indictment of middle and small size industries as well. Being in business, it would seem to be to their advantage to contact the local post-secondary schools to search out personnel trained to meet their needs. It is almost as surprising that no real effort has been made in this direction either. Perhaps they have not had the time to give this particular approach much thought. And perhaps also this effort will trigger a corresponding effort on the part of industry to initiate some action in this direction.



The question, "Does the curriculum meet the current needs of industry?", provokes many varied responses although no industry answered, "No." The course most often mentioned and commented on was one that really does not have anything to do with EM Technology and that was English or the writing of English. One employer put it very succinctly, "I lose more time because orders for repair parts, made out by some of my people on the simplest of forms, cannot be understood by the suppliers and are returned unfilled. And to me, time is money."

The need for a good foundation in basic English was expressed in other ways. Answering letters from prospective customers, writing or filling out reports. Numerous employers expressed a need for employees to be able to communicate ideas. One employer said he had to let one young man go because, unbelievably, he could not read. This is in a county where the high schools are consistently rated as among the best in the country. A common comment was that the English course presented should relate in some way to the technology being presented.

It is encouraging to know that community colleges in general or, probably more fairly, the educational hierarchy, has recognized the importance of English and its many derivative subjects by making them mandatory subjects in most post-secondary schools. The job then becomes one of making the English course the most appropriate and effective.

The course that received almost as much attention as English was drafting and courses derived from this broad category, such as one that covers the training needed to properly read a blueprint. This was especially true of the smaller companies. Many of the descriptions for orders at these companies are detailed in drawings. In smaller companies there is a greater need for cross training since one man's absence has greater impact than in a larger company. Hence, the need for a higher percentage to possess many abilities.

Of course, drafting is elemental to any engineering oriented program. As with English, it becomes a case of designing a drafting course to be the most appropriate and effective for an Electromechanical Technology. An electrical technology curriculum for example, would include a drafting course that would stress circuit drawings; an electromechanical curriculum must concentrate on circuit diagrams and their symbols but would familiarize the student with drawings of gears and pulleys and symbols representing motors and generators as well.

Mathematics was the last of three most often mentioned and discussed courses. There was agreement among industry that the calculus was not absolutely necessary. They felt students should not be discouraged from taking calculus if the desire is there. This thinking on industries' part fits in very nicely with the approach adopted of not making it mandatory but having it available as an elective.

In all candor, however, industries' feeling toward mathematics was stronger than anticipated. Their thinking seemed to go something like this: the more mathematics a student is exposed to, the better he becomes grounded in the fundamentals he is really going to need. The researchers really cannot argue with this logic and even accept it as being very true. It was felt, however that there are other ways of accomplishing the same result. It was decided, at least initially, to leave the mathematics as originally conceived.

The EMT courses as presented by the material were almost unanimously accepted on a course by course basis. Considerable comment and discussion were made about the detailed content of the courses and some general recommendations that can be constructively incorporated into the philosophy of the program were outlined.

One employer did recommend that a course in economics be included in the program. This rather startling recommendation was not what one might first think it meant. He was not thinking of economics as the classical study of forces involved in "supply and demand." He was talking about supply-economy, not using three paper towels to dry one's hands when one will sufficiently do the job or not punching four metal parts out of a sheet of steel when a different punching pattern can result in five. This type of thinking can be incorporated into a program without actually adding a course in economics. His ideas on this were actually very valid since he is in business to make money.

The numerous recommendations made by industry were considered for incorporation into the curriculum. Consideration was as objective as possible. Since the curriculum was being designed to meet the needs of industry, every effort was made to incorporate as many as possible. Only in those cases where the result of incorporation would adversely affect the objectives, as stated, were they not included. Incorporations manifested themselves in many different ways. Some were course changes, actually dropping one course out and substituting another. Some were adoption of philosophies, such as stressing supply - economy, throughout the curriculum. Others and by far the most resulted in additions or deletions to the courses themselves. This was done usually without a change in course title. An example of this type of change was the inclusion, in the materials portion of Mechanism I, of a lesson on ceramics.

On the question of how to keep the curriculum current, the response from the industrial firms was more conventional. Almost without exception the recommendation was to subscribe to the literature, such as trade journals, provided by many professional organizations. Latest trends and developments are covered in this type of information and by keeping up with them, necessary adjustment can be made in the curriculum to keep it relevant and up-to-date. Another recommended method of keeping current was to join professional organizations and attend seminars or symposiums sponsored by these organizations. Still another method which was instigated by the researchers and readily accepted by the industrial people was for the EMT instructors to maintain continual liaison with them and exchange information. This really served two purposes. One was that it did provide a method for exchanging information but it also provides a method for the instructor to maintain the personal contact mentioned earlier.

A few side benefits accrued by suggesting a periodic mutual personal exchange of information between instructors and local industrial representatives. One was to have the representatives visit the school laboratories and offer possible recommendations. Some of the industry people offered to act as part-time instructors in their particular field. Some offered their facilities as subjects of field trips and others offered to present talks to the students about their operation. All these suggestions or offers will be incorporated into the curriculum to some extent, some, of course, more than others.

The objective to ensure job opportunity as soon as the student becomes employable drew the most varied response by the persons interviewed. The most obvious explanation of this reaction is that different jobs require different degrees of formal education and an individual does not practically become employable until that level is reached. This is certainly true but at the same time, is probably an over-simplification of the situation.

It was learned in the interviews that employers differ in their preferences for qualification even among similar positions. One employer may prefer an employee who is being educated formally (maybe at night) at the same time he is working at a particular job. The next employer may prefer an employee who has completed four years of formal college education before being hired into essentially the same job. Both employers have excellent and perfectly valid reasons for their preferences. The former wants to hire at a lower pay scale and have the opportunity to observe the employee to see how he (or she) will work out in the job before making a permanent commitment. It also allows the employer some control in training, especially if he provides financial educational assistance. This is often the case. The latter employer wants a fully trained individual, probably more mature because of the discipline involved in completing formal training and cannot afford the time, effort and possibly money involved in training. These are two apparently opposing hiring practices. But not necessarily, both practices may prove very successful, and that is where the proof of the system lies.

The question becomes: in light of the foregoing, how does the college assist in getting the student a job? The answer: in the opinion of the staff, it is through the personal relationship that is being built up between the instructor at the college and the employers in industry. The better the instructor is familiar with the philosophy and thinking of the employers, the better prepared he is for assisting in getting the student a job. He will not only be familiar with the type of training needed but also at what point in the training applicants will be considered. Knowing the reasoning used by the two gentlemen in the above-mentioned example certainly gives the instructor insight into when and at what point in training an individual could be recommended to either employer. This is the approach being used by the staff.

Because the instruction will be heavily "hands-on" oriented, special attention must be given to the selection of laboratory equipment. This effort is continuing and will be beyond the submission of the final grant report. The equipment must be reliable. It is desirable for it to be as rugged as possible since it must be continually rearranged to meet the requirements of various experiments.

The more compact the equipment the better, but not at the expense of security. Petty theft seems to be increasing, therefore, the less temptation the better. Some vendors' equipment slides into wired racks that are bolted to the benches, when removed the individual components become practically unusable. These characteristics, plus the obvious one that the equipment must be capable of being used to illustrate the various principles desired in the individual experiments or demonstrations, must be kept in mind during the search for equipment.

In this particular effort, the search for equipment was initiated very early, too early in fact. It was started before the subject matter was thoroughly established. It would be better to have had some contact with the local industry and a general idea of curriculum needs established. The search, however, should not be delayed too long since the time needed to establish a list plus the procurement time can become quite lengthy.

The first step in the procedure should be to develop a list of institutions that offer Electromechanical Technology or its equivalent. Once established, an itinerary for visits should be made and the visits started. These should result in determining what vendors to talk to and the ones away from which to stay.

It also results in recommendations for or against particular pieces of equipment. An oscilloscope produced by a very reputable company was eliminated from consideration because of a recommendation made here at Montgomery College by an instructor in another department. Valuable time and effort were saved by contacting the institutions prior to approaching the vendors. As many institutions should be visited as is necessary for the instructor to develop with confidence a list of required laboratory equipment.

This essentially, is the point where the research team stands as of the writing of this report. A list of laboratory equipment has been developed to support the curriculum and initial contact has been made with some vendors.

From now until the program is scheduled to open in September of 1978 the effort will concentrate on selecting the most responsive vendor or vendors, continuing contact with more local industry and preparing in general for opening day. Student enrollment is not the least of all worries but with a determined effort on the part of the instructors and management, it is felt the program will be highly successful.

ATTACHMENT A

Course Title	Cr. Hrs.	Student Contact Hours	Laboratory Hours
First Semester - Freshman Year			
Technical Mathematics	5	5	0
Techniques of Reading and Writing I	3	3	0
Mechanisms I	5	8	6
Technical Drafting	2	4	4
Optional PE Elective	(1)	(1)	0
	15(16)	20(21)	10
Second Semester - Freshman Year			
Technical Physics I	4	6	4
Techniques of Reading and Writing II or Technical Writing	3	3	0
Fundamentals of AC & DC	5	8	6
Mechanisms II	5	8	6
Principles of Healthier Living	1	1	0
	18	28	16
Third Semester - Sophomore Year			
Electronic Devices	5	8	6
Mathematics or Science Elective	3(4)	3(6)	0(3)
Electromechanisms I	5	8	6
Social Science Elective	3	3	0
	16(17)	22(25)	12(15)
Fourth Semester - Sophomore Year			
Electromechanisms II	5	8	6
Engineering Technology or Physics Elec.	4	6	4
Servomechanisms	5	8	6
Humanties Elective	3	3	0
	17	25	16
TOTAL HOURS	66(68)	95(99)	54(57)

ATTACHMENT B

PUBLICATION TITLE

United Physics/FLUIDS Laboratory Text
United Physics/FLUIDS Instructor's Data Guide
Electronics/ELECTRICITY Laboratory Text
Electronics/ELECTRICITY Instructor's Data Guide
Mechanisms/DRIVES Laboratory Text
Mechanisms/DRIVES Instructor's Data Guide
Electromechanisms/DEVICES Laboratory Text
Electromechanisms/DEVICES Instructor's Data Guide
Unified Physics/OPTICS Laboratory Text
Unified Physics/OPTICS Instructor's Data Guide
Electronics/AMPLIFIERS Laboratory Text
Electronics/AMPLIFIERS Instructor's Data Guide
Mechanisms/LINKAGES Laboratory Text
Mechanisms/LINKAGES Instructor's Data Guide
Electromechanisms/MOTOR CONTROLS Laboratory Text
Electromechanisms/MOTOR CONTROLS Instructor's Data Guide
Electronics/DIGITAL Laboratory Text
Electronics/DIGITAL Instructor's Data Guide
Mechanisms/MACHINES Laboratory Text
Mechanisms/MACHINES Instructor's Data Guide
Electromechanisms/TRANSDUCERS Laboratory Text
Electromechanisms/TRANSDUCERS Instructor's Data Guide
Electromechanisms/AUTOMATIC CONTROLS Laboratory Text
Electromechanisms/AUTOMATIC CONTROLS Instructor's Data Guide
Electronics/COMMUNICATIONS Laboratory Text
Electronics/COMMUNICATIONS Instructor's Data Guide
Mechanisms/MATERIALS Laboratory Text
Mechanisms/MATERIALS Instructor's Data Guide
Electromechanisms/SERVOMECHANISMS Laboratory Text
Electromechanisms/SERVOMECHANISMS Instructor's Data Guide
Electromechanisms/FABRICATION Laboratory Text
Electromechanisms/FABRICATION Instructor's Data Guide
EMT Program Compendium
EMT Sourcebook of Schools & Industrial Suppliers
Data Processor Comparisons
D. C. Motor Comparisons
Administrator's Guide
Staff Training Guide
EMT Mathematics Syllabus
EMT Communications Skills Syllabus
EMT Social Science Syllabus

Section XII—Summary Comments and Conclusions

1. Main conclusion -- vocational educators must leave the isolation of the classroom and establish face-to-face liaison with personnel managers and shop supervisors in their particular curriculum industries.

2. If implementation of a new curriculum is being considered, it is necessary to consult with representative employers in person in order to be reasonably certain that jobs will become available. A review of national, regional and state manpower projections may indicate broad trends -- but more exact, local data is needed.

3. At the beginning of the study, business and industry were startled by the unprecedented interest shown by vocational educators to meet their needs -- but they were gratified and quick to cooperate.

4. It is very desirable for instructors to establish and maintain contacts with instructors in other geographical areas who are teaching similar curriculums. This will provide a sharing of developmental knowledge on a broad base.

5. The vocational instructor must assume responsibility for systematic planning and follow-through in order to maintain interchange with his curriculum business or industry. This requires record keeping, continuous revision of job projections, cooperative relations with industrial personnel, and the offering of suggestions where desirable. He must establish a visiting schedule with curriculum industry personnel and strictly follow it.

6. The instructor who has confidence in his ability to produce a good product, the trained student, should accept the added responsibility of helping his student get a job. This may not be difficult if jobs are readily available. But, it may involve a sales campaign on the student's part -- letter writing, filling out applications, applying in locations other than his own.

7. It is necessary to avoid duplication of training in order to prevent drop-out and boredom. The postsecondary institution must take the initiative to ascertain the student's level of knowledge and skill before he begins study of a particular curriculum and to build his program from this point. Where possible, in accord with school policy, granting of credit should be considered.

8. There is opportunity in many curriculum industries for the handicapped and the disadvantaged. The postsecondary institution must include these in its recruiting plans.

9. Throughout man's history, mathematics has been essential to his survival, exploration of his world, trade, and day-to-day living. It is not possible in today's society to get along without a sound knowledge of arithmetic, and the successful achieving of vocational careers demands it. More mathematical knowledge is needed in certain technologies. Further, students should be motivated to study all the mathematics they can master and to which they are willing to devote the necessary time.

10. Advisory committees for particular curriculums should be convened on an ad hoc basis -- when their job is done, let them go home. An advisory committee made up of high-level industrial personnel to advise school authorities can play a political and supportive general role, but is of little use in pointing out developments at the "hands on" level.

11. All students should possess a fundamental knowledge of the computer -- the merchandiser, the secretary, the draftsman, the technically oriented.

12. An essential need of every 18-year old is possession of a skill for which he can be paid. If he has achieved this in high school, well and good. If he is working in a casual job, an attempt should be made to recruit him for vocational or technical training, and if he is enrolled in college, he should be encouraged to use some of his electives to develop job entry skills.

13. How is the high school student to know about his school's offerings and make an adequate judgment? Our high schools are college oriented so that even those who will not attend college are enrolled in general education -- this in high schools offering vocational training. The challenge to the high schools is to get students to enroll in both college entrance programs and vocational skills training.

14. As Alistair Cooke has stated, "America has been able to convince people that they need goods, through advertising." Without advertising, much of our business accomplishment in raising the living standards of our citizenry would never have come about.

Today's students and parents must become aware of vocational and technical opportunities through advertising, and adequate money should be provided in school budgets to employ professional advertisers to do it.

15. No man or woman can live by work alone. Teachers and counselors must encourage their students to develop interests in history, science, foreign languages et al, and thus contribute to the development of a "whole" person.

16. What cannot be summarized here is the vast amount of good will, enthusiasm and feelings of accomplishment on the part of those involved. A word of warning, though -- as Samuel Johnson said of friendship -- "It must be kept in good repair." This interfacing with our partners in business and industry must be maintained with time expenditure and systematic communication. Keep current! The rewards are great!

Appendix A—Manual for Setting Up a Curriculum

This manual outlines a method for developing a curriculum in any given field. It is only one method; other methods may be employed just as successfully.

The philosophy behind this manual is that the curriculum to be developed will be responsive to the needs of local industry engaged in work related to this curriculum. To insure that this is the case the curriculum will be designed with the assistance of local curriculum related industry. This will be accomplished by personal contact between the instructor and local industry's representatives of each organization to work out the curriculum on a course-by-course basis. An important facet of this philosophy is not that the instructor contact the representatives solely to work out the curriculum but that this contact develop into a continuing long term relationship in which the instructor stays abreast not only of the industry's training needs but the requirements and preferences with regard to employees as well.

With this philosophy in mind, the following step-by-step procedure can be used to develop the curriculum.

1. Develop a list of local industries in the field of the curriculum desired.

   Methods: a. Use yellow pages of telephone book.
   b. Contact Chamber of Commerce and local trade associations for information.
   c. Contact industrial professional organizations.
   d. Other methods as locally available.

2. Thoroughly research the field to determine what courses are currently being taught and what equipment is being used by other institutions offering the same or similar curricula.

3. Design a curriculum, based on research accomplished in 2 above, to be used as a "draft" in later interview with local industry.

4. Design an interview guide to be used while interviewing curriculum related local industry. Guide should be such that it stimulates discussion.

5. Design an introductory letter, to be sent to prospective local industries being contacted, explaining the program, that it is planned that they will be interviewed at a later date and will be contacted by telephone. Enclose a copy of the draft curriculum, course descriptions, course outlines and course objectives.

6. Start setting up interviews telephonically.

    a. Attempt to set up two to four per day.
    b. Attempt to schedule same day interviews in same general locale.
    c. Determine whether course material was received.
    d. Attempt to persuade interviewee to review curriculum material prior to interview.

7. Conduct interviews.

    a. Explain program again.
    b. Remember this is first of many personal contacts. Make this fact known.
    c. 1) Solicit comments on curriculum course material.
        2) Solicit recommendations on equipment to be used as an aid in instruction.
    d. Use interview guide to conduct interview.
    e. Let interviewee do talking. His ideas are what is wanted.
    f. See if subject is interested in visiting school facilities.
    g. See if subject is interested in part-time instruction or giving a talk to students on his operation.
    h. Attempt to determine number of people employer might hire in a year.
    i. Solicit ideas.
    j. Take notes (Not to detriment of the interview.).
    k. Organize notes immediately following interview.

8. Make adjustments or changes to curriculum.

    a. This can be done after the first or any of the interviews, especially if the interviewee presents a clearly outstanding recommendation.
    b. This process should be continuing since personal contact will be maintained and industry needs will change.
    c. Give credit to employer who gives a specific recommendation that is incorporated into the curriculum. (This can be done by letter.)
    d. Remember an industry representative is going to give recommendations that benefit him. They must be weighed against the entire industry before incorporation.

The procedures outlined above are a never ending process of industry contact and course material revision. The instructor, however, will reach a point somewhere in this process when he will feel confident enough in the curriculum as developed to order laboratory equipment for each specific course.

The procedure for accomplishing this will vary tremendously depending on the curriculum. Some in fact will require no equipment at all save blackboard and chalk. Others, especially the more technically oriented curricula, will require large numbers of and very expensive equipment. Because methods for obtaining small amounts of equipment are rather trivial, the method outlined below is for the most difficult case, when large amounts and expensive equipment are required.

1. Make a list of institutions that offer the same or similar curricula.

2. Develop an itinerary for visiting these institutions.

    a. Minimize travel time by visiting institutions that are closely situated on the same days.
    b. Discuss equipment with instructors at the schools.
    c. If possible operate the equipment.
    d. Take notes.

3. Start developing a list of equipment.

    a. Continue visits and developing equipment list until a level of confidence is reached that satisfies the instructor.
    b. Consider and incorporate, as appropriate, recommendations made by industrial representatives with regard to equipment. (It may be possible to have an informal panel of selected industry representatives to review the equipment list and make recommendations.)
    c. Ask any appropriate department at the local institution to review the list.

4. Devleop a set of specifications for each piece of equipment.

    a. This will include but not be limited to such data as accuracy, ranges, size, power requirements and weights.
    b. Commercial catalogs can be used to facilitate this procedure.

5. Contact appropriate vendors.

   a. Make them aware of the requirements using the specifications.
   b. Consider any recommendations they may have.
   c. Any information provided one should be provided to all.
   d. Deal with vendors as equitably as possible.
   e. Ask them to make a proposal.

6. Be sure regulations of the local school are complied with throughout the process.

7. Rate the various vendor proposals.

   a. This can be done by the instructor or by a committee.
   b. A rating system based on 100% can be used to do the rating with different factors given various maximums, e.g., cost-30%, responsiveness-30%, time to deliver-10%, etc.
   c. The proposal with the highest rating most often is awarded the contract.

The above recommends a method for developing a curriculum and selecting the equipment for any given field. It should be emphasized that this is only one of many methods that could have been described and that factors existing at one location may dictate other methods be pursued. The success of the curriculum is going to depend, to a large extent, on the ingenuity and common sense of the instructor and his ability to establish an effective liaison with curriculum industries.

Appendix B—Data Matrices

Data Gathering Interview Procedure

1. Prior to each interview, a discussion guide was formulated applicable to the industry and position of the individual to be interviewed. This was not shown during the interview, but was memorized by the researcher.

2. Notes were made during the interview insofar as possible. As soon after as feasible, these notes were transcribed and summarized on a matrix substantially containing the items listed in this discussion guide.

3. The body of the report has been assembled and conclusions drawn from these matrices with the addition of relevant interview notes and opinions.

4. This method has proved highly time consuming -- travel, waiting to see the individual, follow-up, telephone conversations and explanatory tours through the shop and work facilities. These shop tours proved invaluable in establishing a base for continuous liaison.

5. Both researchers are knowledgeable and experienced in electromechanical and other technologies; their backgrounds and assumption of task responsibilities proved complementary in carrying out the project.

The following matrices cover the basic thrusts of the research.

I. Establishment of a new curriculum.

II. Keeping current - riding on the growing edge.

III. Mastery of basic skills means a job.

IV. Train and earn

V. Experience and previous training counts.

VI. General education and library resources.

VII. Student recruitment

Key to Types of Persons Interviewed:

A.	Technicians	40
B.	Personnel Managers	28
C.	Training Officers (business and industry)	20
D.	Educational Personnel Including 6 Recent Students	27
E.	Technical Supervisor	18
F.	Managers	50
	Total	183

Response Key:

Y — Agreed with item

N — Disagreed with item

O -- No comment or item did not arise during interview

MATRIX I
Establishment of a New Curriculum

INTERVIEW ITEMS MOST MENTIONED	A (40)			B (20			C (20)			D (27)			E (18)			F (50)			Total		
	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O
1. Curriculum industry inventory is essential.	27	11	2	26	2	0	18	1	1	18	5	6	14	3	1	44	0	6	147	22	16
2. Random sampling of employers should be made in person.	37	2	1	25	2	1	19	0	1	19	5	3	14	1	3	43	2	5	157	12	14
3. Job openings and projections (short and long range) should be coordinated with the school.	38	1	1	24	2	2	19	1	0	20	1	6	16	0	2	46	1	1	163	6	12
4. Ad hoc committee representative of industries for which curriculums appear to be needed should be convened and consulted.	37	1	2	25	1	2	18	0	2	21	1	5	15	0	3	40	1	9	156	4	23
5. Consultant should be hired to assist in choosing curriculum.	27	1	18	11	1	16	12	1	7	22	2	3	10	0	8	37	2	11	119	7	63
6. Determination of curriculum must be based upon (1) student availability (2) short and long range job probabilities (3) training facility, equipment, competent instructors (4) local financial support.	37	1	2	23	0	5	18	1	1	23	0	4	17	0	1	46	0	4	164	2	17
7. There must be recommendation of a specific curriculum by ad hoc committee and educators, and acceptance of responsibility by school authorities.	37	0	3	20	0	8	12	1	7	24	1	2	10	0	8	39	1	10	142	3	38
8. Curriculum must be developed cooperatively - school and industry.	38	1	1	27	1	0	19	0	1	22	1	4	17	0	1	47	1	2	170	4	9
9. Methods should be established for continuous curriculum change in consonance with industrial needs.	38	0	0	26	2	0	17	1	2	20	0	7	18	0	0	48	0	2	167	3	11
10. Cooperative training equipment selection - education assisted by industry.	34	4	2	25	1	2	17	0	3	18	6	3	17	0	1	47	1	2	158	12	13
11. Heavy concentration on "Hands-on" instruction at least 70%.	37	0	3	26	1	1	20	0	0	20	0	7	18	0	0	48	0	2	169	1	13
12. Familiarization of trainees with actual jobs.	38	2	0	27	0	1	19	0	1	19	0	8	17	0	1	49	0	1	169	2	12
13. An advertising promotion plan is essential:																					
a. To obtain students	24	6	10	19	0	9	12	4	4	25	0	2	6	0	12	49	0	2	135	10	39
b. To involve industry and ensure jobs.	28	4	8	25	1	2	14	2	4	25	0	2	10	0	8	49	0	2	150	7	26

MATRIX II
Keeping Current - Riding on the Growing Edge

INTERVIEW ITEMS MOST MENTIONED	A (40)			B (28)			C (20)			D (27)			E (18)			F (50)			Total		
	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O
1. Maintain interchange with a reasonable number of local curriculum industries systematically.	20	2	18	26	1	1	18	1	1	20	6	1	15	0	3	41	0	9	140	10	33
2. Instructor may submit curriculum segments to industry for review.	28	4	8	25	1	2	19	0	1	17	7	3	15	0	3	46	1	3	150	13	20
3. Convene review conferences - instructors and industrial representatives - no industrial representative to attend more than once a year.	32	3	5	27	0	1	19	0	1	20	7	0	16	1	1	45	3	2	159	14	10
4. Instructor should gather information from industry concerning student performance.	30	4	6	26	0	2	20	0	0	19	7	1	17	0	1	47	1	2	159	12	12
5. Manuals, trade journals, company publications, and other material should be available in the school shop.	35	0	5	26	0	2	20	0	0	25	0	2	17	0	1	47	0	3	170	0	13
6. Schools should provide space for related industrial seminars.				27	0	1	18	0	2	26	0	2	16	0	1	48	0	2	135	0	8
7. Instructor should "feel free" to seek information about new trends - also current methods - from the curriculum industries.	31	1	8	25	0	3	19	0	1	20	6	1	17	0	1	48	0	2	160	7	16
8. Can tours of curriculum industries for students be made possible?	30	1	9	24	3	1	18	1	1	23	2	2	16	1	1	41	7	2	152	15	16
9. Will the curriculum industry provide information to be maintained on the instructor's profile card?	12	0	23	27	0	1	17	1	2	20	1	6	17	1	0	45	4	1	138	7	33
10. Should the instructor maintain knowledge of allied and related technologies?	28	4	8	22	6	2	18	0	0	20	2	5	18	0	0	46	1	3	152	13	18

MATRIX III
Mastery of Basic Skills Means a Job

INTERVIEW ITEMS MOST MENTIONED		A (40)			B (28)			C (20)			D (27)			E (18)			F (50)			Total		
		Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O
1.	Most jobs are obtained by direct application.	31	2	7	27	0	1	16	2	2	20	3	4	17	1	0	40	5	5	151	13	19
2.	Should the candidate work with the instructor in presenting himself for a job?	32	1	7	28	0	0	18	0	2	25	0	2	16	0	2	46	0	4	165	1	17
3.	Is it important that all previous experience and knowledge pertaining to the job be listed in the job application?	35	1	4	27	0	1	20	0	0	22	2	3	17	0	1	45	0	5	166	3	14
4.	Should close contact be maintained between the instructor and personnel manager regarding student aspirations for jobs?	30	1	9	27	0	1	17	1	2	21	1	5	17	0	1	46	1	2	158	4	20
5.	Are company representatives available for classroom discussions?				25	3	2	15	1	4	19	4	4	11	2	5	41	2	5	111	12	20
6.	Should the student usually get a job in his technical area as soon as he can, and continue after-work study?	35	0	5	25	2	3	16	3	1	12	11	4	16	2	0	39	6	6	143	24	19
7.	Must students for cooperative programs be approved by the company concerned?	36	1	3	27	1	0	18	1	1	15	10	2	16	1	1	42	5	3	154	19	10
8.	Can the instructor assist in obtaining part-time jobs in curriculum industries for students?	37	1	2	26	1	1	17	1	2	19	7	1	16	1	1	44	6	0	159	17	7
9.	Should the student be made aware that his entire work record is of great importance to his career?	34	3	3	25	1	2	15	0	5	24	0	3	17	0	1	48	0	2	163	4	16
10.	Is a listing of most skills and knowledge mastered by the student of significant importance in obtaining a job?	35	0	5	26	0	2	19	0	1	20	5	2	17	0	1	47	0	3	164	5	14

MATRIX IV
Train and Earn

INTERVIEW ITEMS MOST MENTIONED	A (40)			B (28)			C (20)			D (27)			E (18)			F (50)			Total		
	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O
1. Is early job entry of great importance to today's students?	36	4	0	24	2	2	1[illegible]	2	1	26	0	1	16	0	2	46	2	2	165	10	8
2. Would it be advisable for the student, assisted by the instructor, to assemble all his skills and relevant knowledge for consideration when applying for a job?	36	0	4	25	1	3	17	0	3	25	1	1	17	0	1	46	1	2	166	3	14
3. Is industry willing to evaluate readiness for job entry on the instructor's recommendation, if the instructor is known to them?				27	0	1	18	0	2	16	4	7	15	2	1	46	1	3	122	7	14
4. Will industry give preference to those with liberal arts backgrounds, but who have skills and knowledge required by the curriculum industry.	13	22	5	10	16	2	9	10	1	14	11	2	8	9	1	23	25	2	77	93	13
5. Is the baccalaureate degree an added asset for a technical job?	10	19	11	7	19	2	6	11	3	13	11	3	6	11	1	19	26	5	61	97	25
6. Is the baccalaureate degree an asset for vocational jobs, i.e., secretarial, business, bookkeeping, library assistant, office manager, etc.	21	9	10	21	3	4	16	2	2	16	8	3	12	2	4	37	6	7	123	30	30
7. Does your employer pay for half or more of tuition costs?	28	7	5	26	2	0	16	1	3				14	2	2	41	4	5	125	16	15
8. Do you favor cooperative programs?	19	8	13	18	8	2	10	9	1	24	1	2	6	11	0	28	20	2	105	57	20
9. Would your company make use of short unit teaching of skills and technical knowledge?	35	5	0	21	2	5	15	1	4				14	1	3	45	2	3	130	11	15
10. Is armed service school training acceptable as preparation for job entry?	34	1	5	27	0	1	18	1	1	22	1	4	17	0	1	44	1	5	162	4	17
11. Can the handicapped be trained for technical jobs?	37	1	2	28	0	0	16	4	0	20	5	2	17	1	0	45	3	2	163	14	6

MATRIX V
Experience and Previous Training Counts

INTERVIEW ITEMS MOST MENTIONED	A (40)			B (28)			C (20)			D (27)			E (18)			F (50)			Total		
	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O
1. Should the educational institution evaluate extra student training and experience for listing with the student's job application?	32	2	6	26	1	1	17	2	1	25	1	1	16	1	1	46	1	3	162	8	13
2. Will the instructor's close liaison with the local curriculum industry assist the student in obtaining jobs in other company locations?	31	5	4	26	0	2	17	2	1	17	2	8	14	1	3	46	2	2	151	12	20
3. Do you favor job entry as soon as the student can hold a curriculum industry job?	33	2	5	26	0	1	18	1	1	17	9	1	14	1	3	41	7	2	149	20	13
4. Is the instructor's assessment of the job applicant regarding attitudes, ability to get along with others, job habits, ability to adapt, et al, of significant importance to the employer?	21	17	2	26	0	2	17	1	2	14	10	3	15	0	3	42	7	1	135	35	13
5. Will curriculum industries assist the school in identifying necessary job related skills?	31	4	5	27	0	1	18	1	1	12	11	4	16	0	2	43	6	1	147	22	14
6. Is industry interested in identifying an individual student as a potential employee while he is still in a student status?	30	4	6	26	0	2	17	1	2	9	15	3	14	3	1	40	7	3	136	30	17
7. Should the high school, the post-secondary institution and industry work together to provide vocational guidance for high school students?				24	4	0	12	4	4	10	12	5	14	2	2	35	11	4	95	33	15
8. Would industry employ technically trained adults who are liberal arts graduates?				17	6	5	12	6	2	20	6	1	10	8	0	34	11	5	93	37	13
9. Would industry like to have the vocational-technical schools and colleges offer short courses as needs arise?	35	1	4	27	0	1	20	0	0	15	7	5	17	1	0	46	1	2	160	10	12
10. Is there a need in industry for tailored programs (made up of selected courses or course segments) on an individual industry basis.	20	14	6	19	7	2	12	1	7	17	7	3	14	0	4	29	14	7	111	43	29

MATRIX VI
General Education and Library Resources

INTERVIEW ITEMS MOST MENTIONED	A (40)			B (28)			C (20)			D (27)			E (18)			F (50)			Total		
	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O
1. Is a basic knowledge of oral and written English essential to success on the job?	32	5	3	27	0	1	17	1	0	22	2	3	13	4	1	47	1	2	158	13	10
2. Should English taught the vocational student be related to the specific curriculum technology?	35	2	3	22	4	1	18	1	1	12	12	3	16	1	1	40	9	1	143	29	10
3. Is additional instruction in English advisable after job entry?	7	22	11	23	2	3	12	8	0	20	6	1	8	10	0	32	8	10	102	56	25
4. Is training in technical English recommended?	14	19	10	25	0	3	17	1	2	10	11	6	10	7	1	41	8	2	117	46	24
5. Is a thorough knowledge of arithmetic essential for most vocational and technical jobs?	36	0	4	27	0	1	17	0	1	27	0	0	17	0	1	48	0	2	172	0	9
6. Are high school algebra and geometry desirable for most technical jobs?	28	7	5	26	0	2	19	0	1	26	0	1	18	0	0	49	0	1	166	7	10
7. Although not essential for job entry, should students be encouraged to study as much advanced mathematics as time and interest permit?	27	11	9	27	0	1	16	2	2	26	0	1	12	5	1	41	3	6	149	21	20
8. Should technical mathematics be studied by those preparing for technical careers.	31	6	3	27	0	1	19	1	0	26	1	0	13	2	3	46	2	2	162	12	9
9. Are applied physics and/or chemistry desirable for technical job entry?	20	14	6	25	1	2	18	1	1	27	0	0	12	1	5	44	2	4	146	19	18
10. Should vocational students be encouraged to enroll in academic science courses?	15	5	20	25	1	2	17	0	1	19	8	0	7	8	3	28	18	4	111	40	30
11. A current collection of related books, journals, visual aids, etc. should be maintained in the school library.	19	17	4	24	1	3	15	1	4	27	0	0	17	0	2	49	0	1	151	19	14
12. Manuals, current publications, information about local industries and a shop shelf of curriculum-related books should be maintained in the school shop.	17	19	4	27	0	1	14	3	3	26	0	1	17	1	0	47	0	3	148	23	12

MATRIX VII
Student Recruitment

INTERVIEW ITEMS MOST MENTIONED	A (40)			B (28)			C (20)			D (27)			E (18)			F (50)			Total		
	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O	Y	N	O
1. Should potential technical employees be well grounded in the use of hand and power tools, elementary electricity, fabrication of materials and mechanical drawing -- high school and/or college?	36	0	4	27	0	1	19	0	1	27	0	0	18	0	0	49	0	1	176	0	7
2. Do you believe that rapidly rising pay scales and job availability will appreciably motivate students to enroll in vocational programs?	35	4	1	24	3	1	18	1	1	17	9	1	17	0	1	46	2	2	157	19	7
3. Is an advertising program describing vocational opportunities highly desirable?	32	4	4	26	0	2	18	0	2	24	2	1	18	0	0	46	1	3	164	7	12
4. Would industry be willing to help by assisting instructors and counselors in increasing their knowledge of vocational guidance?				26	0	2	15	4	1	20	5	2	16	2	0	36	10	4	113	21	9
5. Would industry assist in planning an advertising program by making available public relations specialists -- say once or twice a year?				25	0	3	15	2	3	15	10	2	15	3	0	40	6	4	110	21	12
6. Would industry sponsor a booth or similar at a county fair, a shopping mall, etc. to point out futures in vocational education?				23	2	3	17	1	2	14	11	2	10	5	3	37	5	8	101	24	18
7. Do you believe it is the school's responsibility to carry out an effective advertising plan to "sell" vocational opportunities?	29	8	3	26	1	1	17	2	1	15	10	2	17	0	1	46	1	3	150	22	11
8. Should the school advertise opportunities for some of the disadvantaged and the handicapped?	15	5	20	26	0	2	16	0	3	20	4	3	16	0	2	47	0	3	140	9	33
9. Is it to industry's advantage to encourage employees to enroll in full length or modular courses related to the work performed?	17	10	3	26	0	2	17	1	2	26	0	1	17	0	1	48	0	2	151	11	11
10. Should the school in cooperation with the industry maintain a continuous interest in the employees progress?	30	1	9	25	0	3	15	2	3	18	9	0	14	3	1	37	9	4	139	24	20

Appendix C—The Research Team

Dr. Clifford L. Rall - Principal Investigator

Dr. Rall began his career as an apprentice and journeyman for the General Electric Company where his experience included work in foundries, machine shops, welding, pattern shops, and construction engineering drafting. He has taught vocational education in New York State. As a school superintendent on Long Island, he introduced a curriculum in aviation engines which opened up jobs in aviation for high school graduates. As a community college vocational dean, he was responsible for the establishment and administration of vocational curricula in a New York State College.

Dr. Rall introduced an extensive manpower development training program and increased vocational curriculum offerings from a half-dozen to twenty-six in a large New Jersey city. One of his Navy assignments was to conduct a school for an enrolled 700 aviation mechanics.

As Director of Adult, Vocational and Technical Programs for the United States Office of Education in New York City, Dr. Rall was responsible for programs in four states, where he administered Federal funds and assisted in the planning for technical institutes, area vocational schools, and manpower training programs.

For ten years Dr. Rall served as Superintendent of Schools, chiefly in New York and New Jersey cities. Prior to this, he held principalships of elementary, junior high and senior high schools. He has taught at Farleigh Dickinson, Yeshiva and Rutgers Universities.

Dr. Rall is currently employed as Vocational Technical Education Specialist for the Germantown Campus.

Frank E. O'Brien - Research Associate

A graduate of the United States Military Academy at West Point and holder of a master's degree in electrical engineering from Northeastern University, Mr. O'Brien is currently a member of the faculty of the Germantown Campus of Montgomery College.

He served as an Executive Officer with the U.S. Army in Vietnam where he was awarded two Bronze Stars and commanded the

Army Signal Battalion in Korea. Colonel O'Brien was a member of the faculty at West Point for three years; he also served as the Deputy Director for Instruction of the Academic Computer Center. His experience encompasses monitoring installation of a guided missile complex for the defense of New York City; a stint in an advanced development laboratory of the Raytheon Company, and as Executive Officer of a center employing 250 scientists and engineers and some eighty military personnel for the Defense Communications Agency.

Mr. O'Brien has been selected to put into operation and teach the electromechanical curriculum at the Germantown Campus of Montgomery College.

Patricia M. Koenig - Project Secretary

Mrs. Koenig received her A.A. degree in Secretarial Studies from Montgomery College in 1974. Since that time she has held secretarial positions in various fields -- law, education and the printing industry.

Pat not only contributed valuable and expert secretarial support during the reporting period, but also assisted greatly in advising with regard to printing, layout work and photography, a career she has been pursuing during her spare time.

Her competence, enthusiasm and willingness to work after hours when needed -- all contributed greatly to the success of the project.